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# SCIENCE AND TECHNOLOGY INVESTMENT STRATEGY FOR SQUADRON LEVEL TRAINING

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The Office of Public Affairs has reviewed this report, and it is releasable to the National Technical Information Service, where it will be available to the general public, including foreign nationals.

This report has been reviewed and is approved for publication.

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This report presents a science and technology investment strategy addressing the development of training technology applications relative to current and future training needs and instructional settings of various squadron level training (SLT) environments and methodologies to accomplish training. The report summarizes the findings of surveys, interviews, and archival research conducted to identify current and future training needs of the USAF as they relate to management, development, delivery, and evaluation of squadron level training. These findings are used as the basis for the identification of technologies that can be applied to address training needs. On the basis of the research conducted, a comprehensive investment strategy is presented in this report which provides recommendations and guidance regarding the structure and content of future research activities related to squadron level training.

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## Preface

This report addresses Phase II of a two-phase research effort to analyze Squadron Level Training (SLT) in the Air Force.

Phase I focused on pilots in flying units and enlisted personnel in maintenance units. This initial effort involved 1) convening a meeting of training experts for identifying unit level training requirements, current levels of training deficiency, identifying centralized training transferable to the squadron level, identifying existing and needed technology applications, and developing a preliminary training requirements and technology match ("SLT taxonomy"); 2) development of a structured interview questionnaire and data collection visits; 3) analysis of data; and 4) refinement of the SLT taxonomy based on data collected.

The scope of Phase II is to 1) refine the research methodology developed in Phase I, including data collection and data analysis methods for assessing unit level training in both peacetime and wartime environments; 2) develop a technical approach for evaluating the generalizability of training issues across different types of Air Force units; and 3) develop criteria and a technical approach for assessing the importance of training needs and technology applications.

As documented in this report, the results of Phase II include a comprehensive training requirements and technology match and a Science and Technology Investment Strategy for supporting training technologies at the squadron level.

# SUMMARY

The purpose of this report is to present a science and technology investment strategy that will address the development of training technology applications relative to current and future training needs and instructional settings of various squadron level training (SLT) environments and methodologies to accomplish training.

This report summarizes the findings of surveys, interviews, and archival research conducted to identify current and future training needs of the USAF as they relate to management, development, delivery, and evaluation of squadron level training. These findings are used as the basis for the identification of technologies that can be applied to address training needs.

On the basis of the research conducted, a comprehensive investment strategy is presented in this report which provides recommendations and guidance regarding the structure and content of future research activities related to squadron level training conducted by the Technical Research Division, Human Resources Directorate (HRD), Armstrong Laboratory, Brooks AFB, TX.

It is possible to conceive a world with infinite time and non-depletable resources. In such a world, researchers would have an infinite amount of time to research and develop all that they desire. There would be no need to prioritize; nothing would have to be foregone. In such a world, nothing would be scarce.

In the real world, all important resources are finite. Researchers must make decisions among the various possible research areas. By selecting one path over another, researchers must consider the "opportunity costs," that is the benefit, or value of the benefit, that is foregone by choosing one alternative over another. In a world of scarcity, deciding which problems to address and the methodology to be employed are probably the most important decisions made by a research organization.

## A Changing Environment

The Air Force must structure its training programs within the context of an ever changing environment. A number of trends within this environment have important implications for the AF in terms of training. These trends include: 1) reduction in force size, 2) increased skill demands placed on individuals, 3) continuing importance of on-the-job training (OJT), 4) increased complexity of weapon systems, 5) rapidly changing technology, 6) a diminished national education baseline, and 7) increased use of automated systems.

Regardless of the changes made in the Air Force training structure, squadrons will continue to be responsible for a large share of the training burden.

Trainers at the squadron level will continue to train large numbers of trainees on increasingly complex tasks. Consequently, training technologies will be needed at the squadron level to increase the efficiency and effectiveness of training while not detracting from the operational missions of the units.

## History of the Research

AL/HR, recognizing the importance of training at the squadron level and assuring that research activities focus on specific AF training needs, implemented the Squadron Level Training (SLT) project. Phase I focused on training in aircraft maintenance units. Phase II, building on the findings of Phase I, expanded the scope of the effort to cover a wider range of squadron level training needs. In Phase II, surveys were conducted at AF bases worldwide. In addition, interviews focusing on the SLT training needs were given to a small sample at six bases to verify survey findings and provide a depth of detail that could not be as effectively gathered through the use of structured, self-administered, surveys.

## Overview of the S&T Investment Strategy Document

The S&T Investment Strategy document is intended to provide decision makers with recommendations and guidance regarding research activities related to squadron level training. The S&T Investment Strategy will:

- Identify current training needs.
- Identify potential/future training needs.
- Identify existing technologies that may address current training needs with little or no modification.
- Identify potential lines of research for the development of technologies which do not currently exist or require extensive modification.
- Develop a proposed research agenda to address SLT needs.

# RESEARCH METHODOLOGY

## Overview

The research methodology required a systematic procedure for gathering data on SLT needed to identify significant areas of research which would benefit the Air Force. This section describes in moderate detail how each of the basic activities were developed and carried out. Those readers wishing a highly detailed, in-depth explanation of the various research activities are invited to review the Appendices of this report. The research activities will be discussed in the following order:

- Instrument Development
- The Sampling Plan
- Data Collection
- Data Analysis
- Identifying Technologies
- Matching Technologies to Current and Future Air Force Needs

## Instrument Development

The primary sources of information used to determine squadron level training needs were the three surveys given to Training Managers, Trainers, and Trainees, supplemented by interviews and archival research.

In the development of the surveys, the following steps were carried out.

- Identify the population.
- Develop survey and interview items that address the specific types of information identified.
- Pilot test and refine the instrument.

## Identifying the Population

In order to identify SLT needs, it was first necessary to identify those who are directly affected and involved in training at the squadron level. Preliminary examinations of the activities involved in squadron level training, as well as the results of the Phase I assessment of Pacific Air Forces (PACAF) training for aircraft maintenance, revealed that there are three groups of enlisted personnel with different levels of involvement in squadron level training. These are: 1) Trainees - the recipients of training; 2) Trainers - those who deliver (and sometimes develop) training at the local level, including on-the-job (OJT) training supervisors; and 3) Training Managers - those who manage the training activities on each base.

The following operational definitions for the three groups were used:

- Trainees. Those who have undergone unit level training within the past year and have enough experience in the Air Force to judge the relevance of that training to their jobs.

- Trainers. Trainers include work center supervisors providing oversight to OJT, those providing ancillary training, as well as those providing formal classes on base.

- Training Managers. Training Managers are those who perform the administrative and managerial tasks such as scheduling, documentation of training completed, scoring exams, record-keeping, and so forth to support squadron level training on each base. Training Managers may or may not hold the 75XXX AFSC.

A pre-identified sub-category of the populations of interest were those who had participated in Desert Shield/Desert Storm. This was felt necessary in order to gain insights on training in a wartime environment.

## Survey and Interview Items

The purpose of the surveys and interviews was to collect information for the development of a Science and Technology Investment Strategy for AL/HR from which a report will be prepared to address the development of training technology applications relative to current and future training needs and instructional settings of various SLT environments and methodologies to accomplish training.

To address this goal, separate surveys and interviews were drafted for Training Managers, Trainers, and Trainees. A single survey and interview for all respondents would have been extremely long and burdensome to the intended respondents. Further, responses to a very long instrument were felt likely to be unreliable, as respondents could lose interest or become annoyed by items having low relevance to their own situation.

All survey items were developed using fixed sets of responses. For some items the respondents could select more than one response; for others the respondents could select only one response.

The items were grouped in the following manner:

Training Managers Survey:

- Demographics
- Your function in managing training
- Scheduling
- Training development
- Documentation
- Reporting
- Evaluation
- Opinions about training
- Future training
- Your training activities during Desert Shield/Desert Storm

Unit Level Trainers Survey:

- Demographics
- OJT trainer/supervisor
- Training development
- Training delivery
- Opinions about training
- Future training
- Your training activities during Desert Shield/Desert Storm

Recipients of Training Survey:

- Demographics
- Methods of training
- Upgrade training
- Ancillary training
- Your training activities during Desert Shield/Desert Storm

When constructing the surveys, items were created to cover each step of the Instructional System Development (ISD) process, as well as to explore potential problem areas concerning each task in delivering and managing unit-level training. Appendix A lists survey items against specific ISD process characteristics.

Since the responsibilities and experiences of the three survey groups were not the same, the surveys were not identical. When possible, the same question was asked to two or more of the various groups allowing comparison across groups. The interview instruments were developed following the same general process as that used for the surveys. The interview format used allowed free response but, because we noted during pilot testing that most responses fell into a limited set of possible responses, a checklist of these responses was provided. This was done in order to speed the interview process by reducing writing time. Respondents were

not cued or given possible responses, but were allowed to respond freely. (Copies of the surveys and interviews can be found in Appendices B and C respectively.)

### Instrument Pilot Test and Refinement

An initial pilot test of the survey items was conducted at Andrews AFB, MD. Input from the participating active duty personnel helped in the wording of items and identification of important general environmental and administrative characteristics of training at the unit level.

Both the surveys and interviews were again tested at Randolph AFB, TX. Based on the pilot test findings, survey questions were modified and the interview format was significantly modified. During the pilot test, we discovered that most of the responses to the questions could be classified into a limited set of categories. Taking advantage of this factor, the interviewer guide was modified, allowing the interviewers to quickly code a response. If the response fell outside the pre-coded responses space was available for the respondents' answers to be written.

### Sampling Plan

The following criteria guided the development of the sampling and data collection plans for the surveys and interviews conducted:

- The sampling and data collection plan must be administratively feasible, i.e., within the constraints of normal AF operations.
- The resulting data should be representative of the population of interest to AF policy makers.
- The results should be generalizable to the overall AF enlisted population.
- The data should facilitate comparisons among types of AF personnel classified in multiple ways, such as by AFSC, by years of service, by type of location, and so forth, in order to examine whether findings are the same or different for various types of personnel.

<u>Trainee Sample</u>: A total of 1589 airmen completed the survey out of 2663 contacted. These were clustered in the E3 to E6 pay grade. Only two individuals were out of this range, one airman basic and one airman. The expected return rate was 1000, assuming a 35% return rate. The actual return rate was 57%, which is unusually high for survey research. For the telephone interviews conducted, 40 additional Trainees were interviewed.

Trainer Sample: A total of 2645 potential respondents were contacted to complete the Trainer Survey. Of these, 246 indicated that they did not match the requirement set forth in the cover letter of the survey. 1379 respondents completed the Trainer survey, or 54% of those contacted. This again is well above the normal return rate for a survey. An additional 40 Trainers took part in the telephone interviews. The pay grade of the Trainers ranged between E4 and E9. A cover memo was attached to the survey form, indicating the types of individuals who were defined as Trainers. Those who believed they did not fit this broad definition checked off a box on the cover memo indicating that it was not applicable, and returned the survey to the on-base distribution point. Those who fit the definition of Trainer given on the cover memo completed the survey and returned it to the distribution point. The resulting data are felt to adequately represent the population of Trainers.

Training Manager Sample: The Training Manager Survey was completed by 400 respondents, with an additional 38 respondents taking part in the telephone interviews.

Since Training Managers comprise a relatively small population at any one base, the full population of Training Managers on the sampled installations were asked to complete the survey in order to yield a sufficiently large sample. From an exploratory site visit to Andrews AFB, it was estimated that large bases may have twenty to thirty people functioning as Training Managers.

Instructions contained in the cover memo of the Survey Form for Unit Level Trainers instructed those Training Managers mistakenly given the Survey Form for Unit-Level Trainers not to complete the Trainer's survey, and request a copy of the Survey Form for Training Managers from their point of contact. This sample of Training Managers constituted a probability sample of the Training Managers, since they were to be drawn from the same base population as Trainees and Trainers.

For this project, we believed it was desirable to include in the survey, Training Managers who were performing outside of their primary AFSC in order to understand how often this occurs. Including these individuals also revealed whether the current uses and future needs for training technology among those without formal preparation for the career field are different from those serving in the career field.

## The Sampling Strategy

The returned questionnaires from 3,368 individuals in the surveys of Trainees and of Trainers provided large enough samples for a variety of sub-group analyses of the types indicated above. The initial samples were large enough to allow for expected non-returned surveys, and for a number of "not applicables" among the Trainers.

In constructing the sampling strategy, we assumed that the intended target population is **the total enlisted Air Force population who fall within each survey group**. Using this definition of the target population and probability-based methods for sampling, the survey results were generalizable to the total population of policy interest. Generalizable comparisons could also be made about the perceptions and needs for training of those within larger versus smaller bases, maintenance versus non-maintenance occupations, major versus less populous AFSCs, and so forth. Given the focus of the project on squadron-level training, this definition of the target population was desirable because those with the greatest current training needs may in fact be those who are not in the larger bases or most populated AFSCs.

A probability sampling procedure was used to draw the sample. Probability-based procedures yield generalizable population estimates of calculable precision. With the use of probability sampling procedures, the sources of biases or non-generalizability can be accurately calculated.

When considering population definitions and sampling strategies, all sub-groups that were included in analysis did not need to be explicitly created at the time of sampling, i.e., in a stratified sampling plan. Particularly when the sample was likely to be analyzed for differences among a number of sub-groups (e.g., by AFSCs, by years of service, by grade level, by size of current installation, by types of specific responsibilities for training, by those with or without certain prior experiences, etc.), it is usually preferable <u>not</u> to stratify the sample *a priori*. Instead, the sample should be drawn to be representative of the total defined population, then various sub-groups are examined during the analysis stage.

A **two-stage sampling technique** was used. Air Force installations were sampled with a probability proportional to their size (i.e., larger installations having a higher probability of being in the final sample). Then, individuals who met the criteria for the Trainee and Trainer groups were sampled within the selected installations using a uniform sampling fraction across installations, so that larger installations had proportionally larger shares of the final samples. The Training Manager sample was the full population of Training Managers within the sampled installations. This sampling strategy required actual data collection only at sampled installations, which permitted the use of on-base data collection procedures. It was necessary to limit the initial selection of bases to those above a certain minimum size (only bases with more than 1,000 enlisted), to avoid having a large number of installations with only a few sampled individuals in the study.

The Air Force Military Personnel Center Survey Branch was consulted and confirmed that the statistical and operational support for this type of sampling was obtainable. The sampling of installations, and of individual Trainees and Trainers was completed by the Armstrong Laboratory using the personnel records data files. These procedures generated lists of sampled individuals for the Trainee and Trainer surveys, organized by installation.

## Data Collection

Current problems and future needs identified in this report are primarily based on the results of analysis of the survey and interview data collected.

The Technical Training Research Division, Human Resources Directorate of the Armstrong Laboratory directly managed the distribution and collection of the surveys. Analysis was performed under contract by Hay Systems, Inc.

On-base data collection was used for the survey and interviews. The Survey Control Officer (SCO) on each base managed the distribution of surveys, with assistance from the Base Training Manager when needed to identify Training Managers. The individually addressed survey questionnaires, answer sheets, and names of sampled persons for each type of survey on that base were mailed to the SCO. The SCO was responsible for contacting the sampled individuals and obtaining the completed survey form. This on-base data collection procedure was particularly appropriate with a two-stage sampling plan used. Using an on-base SCO also provided much more assurance of a good response rate.

The telephone interviews were a small sample study conducted with respondents identified and scheduled in advance at six CONUS bases. No significant problems were encountered in collecting data using this approach.

## Data Analysis

### Analysis Software

In order to perform statistical analysis on the data collected, the SPSS statistical analysis package was used. This package allowed rapid exploration analysis and preparation of tables and charts directly from the data.

### Lay-out of Analytic Data Files

The creation of analytic data files from the OpScan form was done by data processing personnel at the Armstrong Laboratory. Data fields were of fixed length, from the OpScan input. For items that are of the "Mark all that apply" type, a separate data field was used for each alternative, entering a "1" if checked, and "0" if not checked. This permitted easy analysis and simplified the creation of summary variables, such as the number of items checked on the question. For items with a response scale, e.g., "strongly agree" to "strongly disagree", the response letters were converted to a numeric 1 to 5 scale, to permit quantitative analysis.

Explicit conventions were set up for handling missing data elements and the "don't know/not applicable" responses. The Data Analysis Code Sheet in

Appendix D provides a detailed description of each item meaning location in the data string and conventions used.

## Data Cleaning

After creating each analytical file, numerical data was examined for any illegal values, or extreme outliers. Outliers found were checked against other data elements in the record, or in reference to the personnel data and corrections were made if feasible. Changing illegal values to a missing data code was a last resort. Overall the data files provided by the Armstrong Laboratory contained remarkably few errors.

## Analysis

The methodology used for the analysis of the data is described in detail in Appendix E, the Squadron Level Training Data Processing and Data Analysis Plan.

The following steps in data analysis were used for each form as its data became available after data entry and cleaning. With this type of exploratory survey data analysis, the range of specific analyses to be performed is very large, so the expected outcomes could not be predicted in advance.

Step 1 - Frequencies. The numbers and percentages for the full set of responses for each item were examined. The frequencies and percentages for many items were of interest in themselves, such as the types of training experienced, delivered or managed; the perceptions of problems encountered; the types of training technology used; and opinions about the current unit-level training situation.

Step 2 - Create Summary Variables. The use of summary variables made the data easier to understand. These variables tend to be of two types: 1) refined sets of categories to be used in later cross-tabulations, such as the AFSC job category; or 2) continuous variables measuring something on a numeric scale, such as a summary index of problems perceived with a specific type of training.

Step 3 - Cross-Tabulations and Comparisons of Means. The analyses helped to understand whether respondents from different backgrounds or with different experiences in the Air Force tend to react differently to the survey items. A cross-tabulation is a table for examining the relationship of one categorical variable to another categorical variable, usually using the $X^2$ statistic for testing the presence of an overall relationship. For example, do Trainees from different AFSCs tend to experience different methods for job-related training? Do Training Managers "with" versus those "without" the 75XXX code as their primary AFSC tend to have different functions in managing training? Do they use technology differently?

A comparison of means was used to examine differences among subgroups on a quantitative item, such as items scored from "strongly agree" to "strongly disagree," or a scale combining several such items. For example, do Training Managers coming from different types of squadrons tend to respond differently to the items about problems with documentation or scheduling? Do Trainees from different AFSCs have different opinions about the training technology they have experienced?

A large number of exploratory analyses of this type were feasible, especially using the summary variables discussed above. The results of the most significant or surprising of these analyses are presented in this report.

Some of the sub-groups that were examined within these data concerning Squadron Level Training are the following:

- Types of units
- AFSC job classes, collapsed as needed into major groupings
- Training Managers "with" versus "without" the 75XXX AFSC
- Grade level, E-3 to E-9 (as relevant for each survey form)
- Major Command (MAJCOM)
- Years of active duty service, categorized as less than 1, 1 to 2, 2 to 3, 3 to 4, or 4 or more for Trainees; categorized as 1 to 4, 5 to 8, 9 to 12, 13 to 16, or more than 16 for Trainers and Training Managers
- Role in the training process for Trainers and Managers
- Training Managers who spend most/all of their duty time on training activities versus those who spend little of their duty time on training
- Trainees who have experienced different types of training technologies

Step 4 - Correlational Analysis. This technique was used to understand relationships among continuous items, and to analyze more complex patterns of relationships. Since these surveys were intended primarily to obtain descriptive information about current squadron-level training practices and perceived needs for the future, the items were not designed to test particular hypotheses or causal models. Nevertheless, some exploratory analyses of potential relationships were feasible.

## Specific Analytic Questions

The analytic steps outlined above all involve using the data from these three groups of respondents to understand the current extent of use of technologies for unit level training, and respondents' assessments of the effectiveness, reliability, problems, or other applicable dimensions associated with that aspect of training. Interpreting the nature of the respondents' perceptions in light of the extent of their experience with a technology provided information for making inferences concerning a match between current and future needs and technologies.

Most sections of the surveys and interviews examined a specific topic concerning training, such as OJT, ancillary training, or management functions such as scheduling, record-keeping or evaluation. This allowed the use of the following general logic to examine topic areas given with their corresponding specific analytic questions (AQ):

A. What training has been experienced or which sub-tasks does the respondent do, in regard to this topic?

> AQ: What is the respondent's role/experience with this Topic?

B. What is the respondent's scope of use (e.g., % time on that activity, # years of experience) with that topic?

C: What technologies/methods have been used for this topic?

> AQ: How extensive is the current use of training technologies in comparison with the use of other methods (manual, one-on-one instruction, etc.)?
>
> AQ: Does the extent of use of technologies versus other methods differ for the various topics? Differ among types of respondents?
>
> AQ: Does the extent of use of training technologies in comparison with other methods differ by the respondents' roles or scope of use (i.e., items A & B)?

D. What are the respondents' assessments of the effectiveness, reliability, types of problems, etc. concerning that topic and/or their use of technologies for it?

> AQ: What are the major problems (needs) perceived at the squadron level with local level training?
>
> AQ: Are the assessments or problems (needs) related to the extent of use of a specific method?

AQ: Are the reported assessments or problems (needs) related to the respondent's role or scope of use on that topic?

Since each of the topic areas may also differ among one or more of the various sub-groups, a large number of exploratory data tables were examined to determine whether the finding for a topic differed by sub-group or could be safely generalized across the respondents to each survey. The presentation of reported results include only those sub-group analyses that show meaningful differences among sub-groups.

## Identification of Technologies

The use of the data analyzed for matching current and future needs with currently available mature technologies, and those technologies currently under development which are expected to play a more important roll in the future, was based on logical interpretations of the findings in relation to the potential uses and characteristics of technologies - both those currently available and feasible future developments. For this logical analysis, additional information about the nature of the technologies was needed to compare with the findings from the surveys.

Those problems and needs that appeared to be addressable through some form of technology were prioritized and the general characteristics of technologies that can address each problem and need were then identified. Research was then conducted to determine which problems and needs are currently being addressed in the Air Force through an existing program, or for which research is currently conducted, or is in the process of implementation. Those identified as belonging to this category were then documented. Current and future needs not being addressed by current AF research were identified and documented.

The identification of technologies that could potentially benefit squadron level training required a review of a broad range of technologies and their current and proposed applications. Some of the available sources of information of potentially useful technologies were:

- Current research and development activities within the Air Force
- Other services' research and development activities
- Professional journals and publications dealing with technology and training
- Subject matter experts
- University sponsored research

The initial identification of potentially useful technologies is based on two questions:

- What technologies can be applied to solve current or potential problems faced by the Air Force in squadron level training?

- What technologies may benefit and improve squadron level training even though no problem has been identified?

In addressing the first question, the researchers first identified problems and needs. The survey and interview phases of this project provide the basis for the identification of problems and needs. Project researchers then identified generic characteristics required of a technology to address an identified problem or need.

Addressing the second question requires a broader perspective. Because of the rapid advances being made in technology, the possibility exists that a technology or a specific application of a technology could radically change approaches to training and management at the squadron level.

Numerous examples exist in various fields where a technology and its application has had revolutionary effects. The advent of integrated circuits (ICs) increased the reliability and decreased the cost of practically every electrical component used today. Without ICs, the low cost personal computer would have never existed. Liquid crystal displays, in combination with ICs, have lowered the cost of watches to such an extent the price of most digital watches is primarily based on aesthetic value rather than accuracy.

In investigating technologies that could improve training even though no problem exists, the researchers first investigated the technology and decided if it could be applied to training. By applying the criteria for evaluation described in this report and contained in the Science and Technology Checklist, some technologies were identified that could prove to be of considerable value to Air Force training.

## Matching Technologies to Current and Future SLT Needs

### Screening Technologies Through the ISD Model

After the initial selection of potentially useful technologies, screening of the technologies was required. The evaluation criteria and strategies used for initial screening of potentially useful technologies were to be those proposed in Chin, Wimpee, Laue, Pedersen, and Green (1992). The framework used was the end product of repeated reviews, modification, and refinement by AL/HRT ISD experts.

The use of this ISD-based framework has several features which make it appropriate for the evaluation of technologies as they apply to training development, delivery, and management. The ISD model covers a wide range of training activities, including planning, programming, development, delivery, management, and evaluation. The ISD model can be defined so as to differentiate between the unique functions of various training technologies. The overall structure and concept of ISD is widely accepted within the AF and other training communities. The use of this model allowed closer comparison of Phase II findings with those from the Phase I research.

The three survey instruments, when taken together, cover the major aspects of the ISD process. No single survey addresses all ISD functions, since the personnel surveyed are involved or could likely be involved in only some of the aspects of the ISD process. Trainees, for example, would not be involved in defining job requirements, developing objectives, or validating instructional materials. Consequently, asking questions related to these topics from an audience of Trainees would not yield useful information.

Appendix A provides a listing of the major ISD process categories and the specific survey items that address the process. The appendix does not list demographic items which were used to categorize process-specific requirements.

Since Phase II of this study incorporated studies of technologies and research outside of the AF, the findings of Phase II could be expected to vary somewhat from that of Phase I. Nevertheless, Phase II research confirms many of the findings of Phase I. (See Appendix F, Relating Training Systems Needs to Training Technologies, for a discussion of the evaluation criteria and strategies as used in Phase I.)

The ISD-based framework served as the initial "screen" to identify those technologies which were further analyzed as to their appropriateness to training needs through the use of the Science and Technology Investment Strategy Checklist.

### Prioritize Findings

Current problems and future needs identified through quantitative and qualitative analyses of the data gathered were then prioritized. The initial prioritization was based on generalizability of the problem and the perceived importance to overall squadron level training.

### Review of the Listed Problems and Need

The list of current problems and future needs was reviewed by the research staff. As part of this review, current problems and future needs were grouped into

clusters of related problems that may be addressed through a single technology or related technologies. Those problems and needs that did not seem to be addressable through technology were identified and eliminated from consideration. The reasons for their non-selection are discussed in this report.

### Preparing an S&T Checklist

For each of the remaining problems and needs, a Science and Technology Investment Strategy Checklist was prepared. The S&T Checklist, used as a tool in this study, goes well beyond the identification of technologies. It is a listing of specific questions and topics that need to be addressed in the selection, program design, research, and implementation stages. The use of the S&T Checklist assures that important topics to the development and implementation of a technology are addressed. As part of the Investment Strategy, the checklist was used to identify factors which could affect the success or failure of a line of research. We define success as the implementation and use of the products or findings of research. The S&T Checklist and its companion documents can be found at Appendices H, I, and J.

# SIGNIFICANT FINDINGS OF SURVEYS AND INTERVIEWS

A large quantity of useful information/data was collected through the administration of the surveys and interviews previously discussed, and numerous analyses were performed. This section will describe the demographics of the various sample populations, and the results of the analyses which appear to be of most significance to the project.

### Demographic Characteristics of Samples

Although the survey was administered Air Force-wide, approximately one-half of the Training Manager, Trainer, and Trainee respondents were from MAC, SAC, and TAC. (Note that the survey was administered prior to the activation of Air Force Combat Command, Air Mobility Command, and Air Force Materiel Command.) In addition, a large portion of the surveys were administered in the overseas commands of PACAF and USAFE. Unfortunately, MAJCOM identification was structured for administration of the survey in CONUS only. The survey was subsequently administered overseas as well, forcing all overseas respondents to respond "Other" to their parent MAJCOM. The survey sample was also heavily weighted by type unit of assignment. Over one half of the respondents in each category were assigned to one of six type units: Aircraft Maintenance, Civil Engineering, Communications, Security Police, Supply, and Training. The "Training" unit of assignment may be somewhat misleading, in that some who selected this option may actually be in Training sections of other type units such as Aircraft Maintenance or Civil Engineering, etc.

The interviews were conducted with personnel from MAC, SAC, and TAC only. The interviews were conducted telephonically with Training Managers, Trainers, and Trainees from MAC's Pope AFB and Scott AFB, SAC's Offutt AFB and McConnell AFB, and TAC's Langley AFB and Nellis AFB.

The distribution of both survey respondents and interviewees by MAJCOM and unit of assignment may be found in Appendix G.

## Grades of Survey Respondents

There were 400 Training Managers, 1379 Trainers, and 1589 Trainees who responded to the survey. Table 1 reflects the grade distribution of the respondents.

Table 1. Grades of Survey Respondents

| | Training Managers | | Trainers | | Trainees | |
|---|---|---|---|---|---|---|
| | # | % | # | % | # | % |
| CMS | 2 | 0.5 | 2 | 0.1 | 0 | 0.0 |
| SMS | 7 | 1.8 | 21 | 1.5 | 0 | 0.0 |
| MSG | 74 | 18.5 | 575 | 41.8 | 0 | 0.0 |
| TSG | 107 | 26.8 | 756 | 54.9 | 46 | 2.9 |
| SSG | 149 | 37.3 | 17 | 1.2 | 627 | 39.5 |
| SGT/SRA | 55 | 13.8 | 5 | 0.4 | 645 | 40.6 |
| A1C | 0 | 0.0 | 0 | 0.0 | 269 | 16.9 |
| AMN | 0 | 0.0 | 0 | 0.0 | 1 | 0.1 |
| AB | 0 | 0.0 | 0 | 0.0 | 1 | C.1 |
| CIV | 6 | 1.5 | 0 | 0.0 | | |
| UNK | | | 3 | | | |

As can be seen, this was a relatively experienced group of respondents. Eighty-five percent of them had four or more years of service.

## Grades of Interviewees

There were 38 Training Managers, 40 Trainers, and 40 Trainees interviewed. Table 2 reflects the grade distribution of the interviewees.

Table 2. Grades of Interviewees

| | Training Managers | | Trainers | | Trainees | |
|---|---|---|---|---|---|---|
| | # | % | # | % | # | % |
| MSG | 6 | 15.8 | 3 | 7.5 | 0 | 0.0 |
| TSG | 7 | 18.4 | 11 | 27.5 | 0 | 0.0 |
| SSG | 17 | 44.7 | 14 | 35.0 | 0 | 0.0 |
| SGT/SRA | 6 | 15.8 | 10 | 25.0 | 3 | 7.5 |
| A1C | 0 | 0.0 | 2 | 5.0 | 21 | 52.5 |
| AMN | 0 | 0.0 | 0 | 0.0 | 15 | 37.5 |
| AB | 0 | 0.0 | 0 | 0.0 | 1 | 2.5 |
| CIV | 2 | 5.3 | 0 | 0.0 | 0 | 0.0 |

Overall, the interviewees were generally more junior than the survey respondents.

## Other Interviewee Demographics

Training Managers and Trainers who were interviewed were asked if that was their primary or additional duty. Table 3 reflects their responses.

Table 3. Percent Training Primary/Additional Duty

| | Training Managers | Trainers |
|---|---|---|
| Primary Duty | 87% | 20% |
| Additional Duty | 13% | 80% |

In a related question, Trainers were asked if they were instructor-qualified. Only 30 percent indicated they were.

**Significant Survey Findings**

Copies of the survey instruments used, annotated with frequency response percentages to all questions may be found at Appendix B. Following are the significant findings regarding degree of automation, time spent on training duties, and training problems identified.

**Training Manager Significant Findings Regarding Degree of Automation**

The following question was among those asked of Training Managers on the survey:

Q. 10: How would you describe the systems you currently use to do your scheduling?

a. Fully automated
b. Automated scheduling from manual input
c. Manual scheduling from automated input (source documents)
d. Fully manual

Figure 1 reflects the percentages of all Training Managers who responded as indicated.

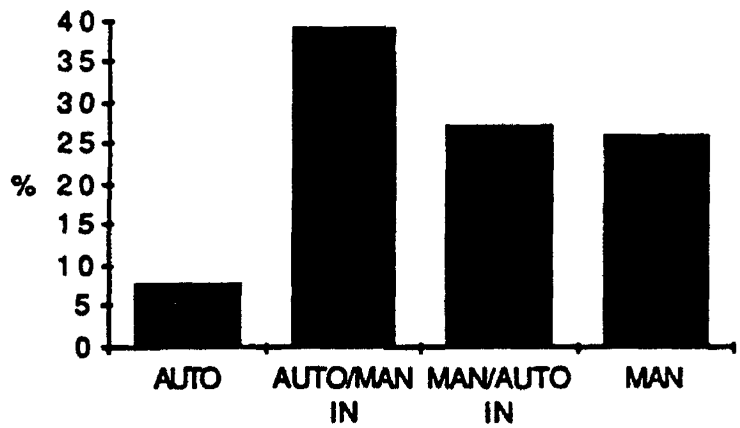



Figure 1. Scheduling Degree of Automation

Aircraft Maintenance was among the most automated for *scheduling* training, and Civil Engineering and Supply were among the least automated. These types of units were examined by selected MAJCOMs. The results are displayed in the next three figures.

Figure 2 reflects the responses to question 10 by *Aircraft Maintenance* Training Managers.

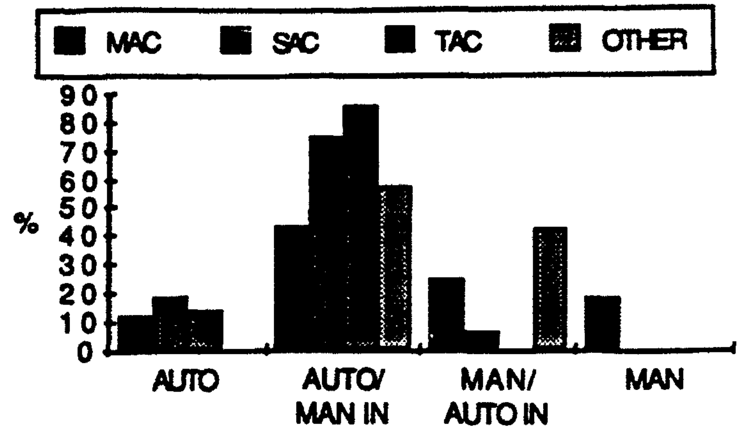



Figure 2. Aircraft Maintenance Scheduling Degree of Automation

SAC and TAC appear to be the most automated in *scheduling* Aircraft Maintenance, and MAC the least.

Figure 3 reflects the responses to question 10 by *Civil Engineering* Training Managers.

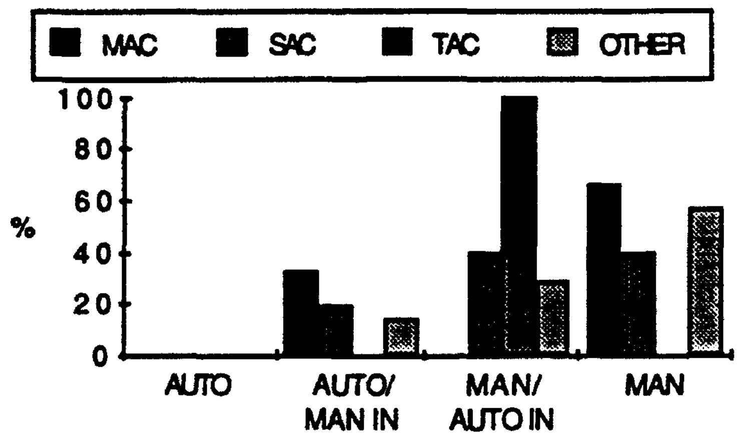



Figure 3. Civil Engineering Scheduling Degree of Automation

With the exception of a small amount of automation in MAC, the Civil Engineering *scheduling* systems of these MAJCOMs are essentially manual.

Figure 4 reflects the responses to question 10 by *Supply* Training Managers.

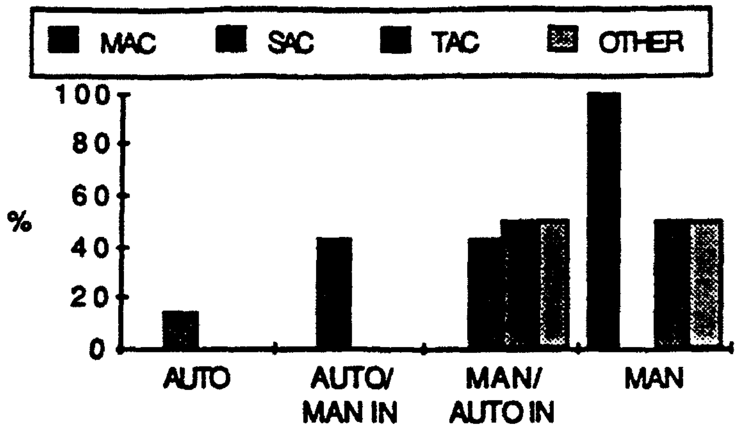



Figure 4. Supply Scheduling Degree of Automation

In Supply, some *scheduling* automation appears to exist in SAC, but none exists in MAC.

**Overall, it appears that SAC has done the most in terms of automated *scheduling*, and MAC the least.**

We then examined each MAJCOM individually to observe the degree of automated scheduling by selected units of assignment.

Figure 5 reflects the degree of *scheduling* automation in MAC.

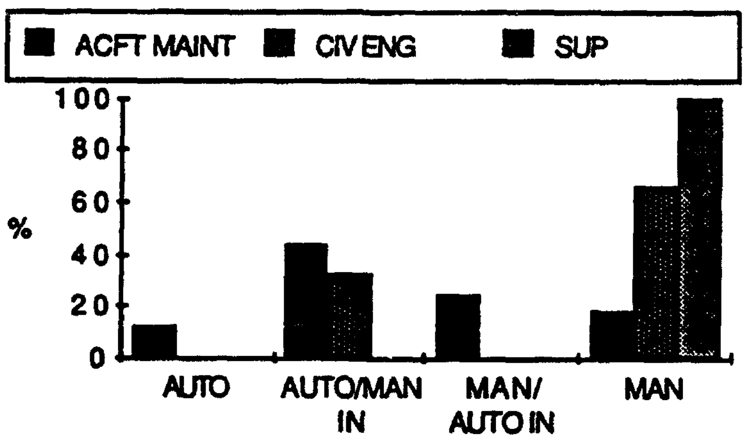



Figure 5. MAC Degree of Scheduling Automation

What little *scheduling* automation that exists in MAC is found in Aircraft Maintenance, with a small amount indicated in Civil Engineering. None exists in Supply.

Figure 6 reflects the degree of scheduling automation in SAC.

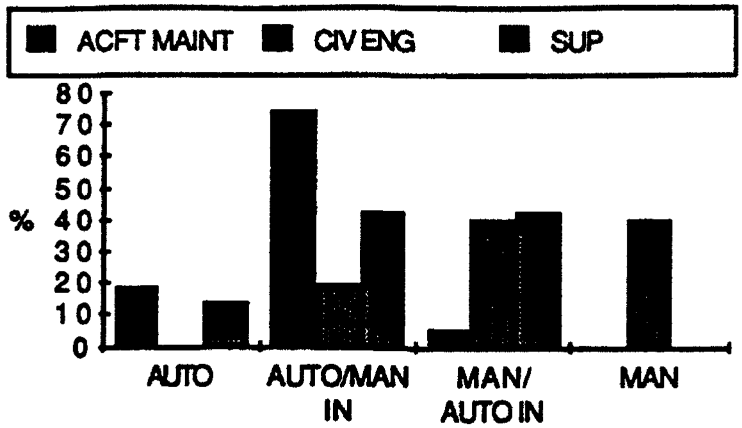



Figure 6. SAC Degree of Scheduling Automation

SAC appears to be highly automated for *scheduling,* particularly in Aircraft Maintenance. In addition, Supply appears to be surprisingly high.

Figure 7 reflects the degree of *scheduling* automation in TAC.

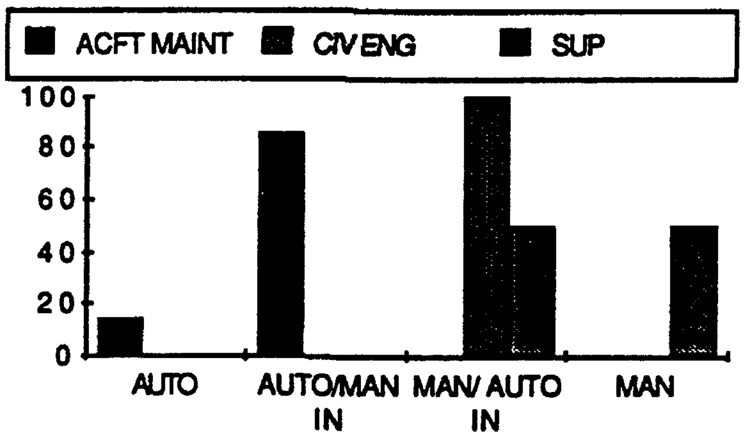



Figure 7. TAC Degree of Scheduling Automation

TAC is highly automated in Aircraft Maintenance *scheduling,* but Civil Engineering and Supply are essentially manual in *scheduling.*

Figure 8 reflects the degree of *scheduling* automation in the "Other" MAJCOMs (essentially USAFE and PACAF).

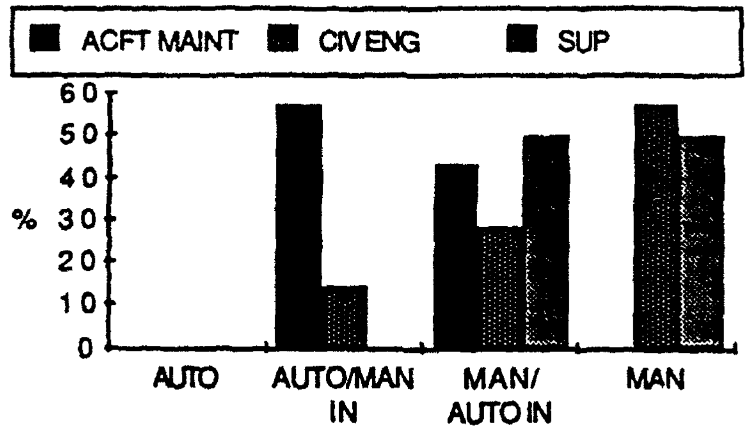



Figure 8. "Other" Degree of Scheduling Automation

What automation there is, exists in Aircraft Maintenance *scheduling*, and possibly a small amount in Civil Engineering.

**In terms of *scheduling* systems, it would appear appropriate to examine SAC's systems, particularly in Aircraft Maintenance. Also of interest would be further examination of SAC's Supply scheduling system.**

The following question was among those asked of Training Managers on the survey:

Q. 33: Please use the following scale to rate each aspect of your documentation activity. (Among the aspects listed): Integrating documentation with other training functions, such as scheduling and reporting.

a. Not a problem at present - no improvement needed.
b. Only minor problems with this at present.
c. Some problems with this - improvement desirable.
d. Major problems with this - improvement urgently needed.
e. Not relevant to documentation.

Over 40% of the Training Managers in *Civil Engineering* cited problems in integrating documentation with other training functions. Figure 9 examines the Civil Engineering responses to question 33 by MAJCOM, and graphically portrays that the most significant problems are perceived by Training Managers in *SAC*. In fact, no other command sees <u>major</u> problems with this activity, and *MAC* sees <u>very little</u> problem with it.

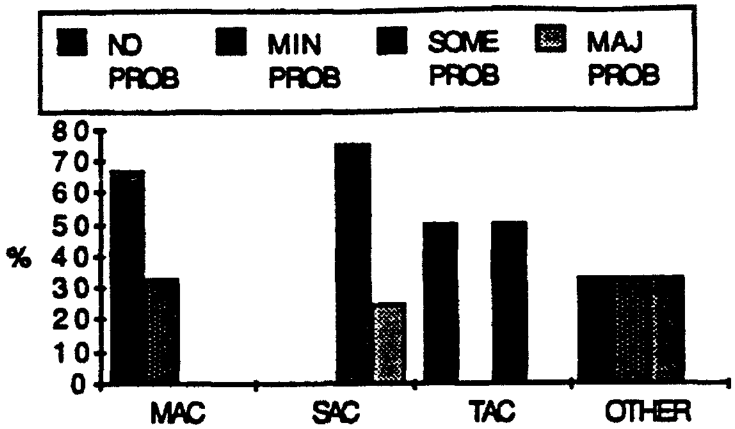



Figure 9. Civil Engineering Training Manager Responses to Question 33

**It is recommended that SAC Civil Engineering functional managers be queried as to their perceptions of problems with documentation integration in an attempt to rectify the situation. This may be directly related to the low degree of automation found in the Civil Engineering training system; however, it is somewhat unusual that one MAJCOM would be so predominant in identifying integration as a problem.**

## Trainer Significant Findings Regarding Degree of Automation

The following question was among those asked of Trainers on the survey:

Q. 31: Please use this set of responses to indicate how frequently you use each of the following methods when delivering training:

a. Use this method with nearly all trainees
b. Use method with about half of trainees
c. Use method with about a quarter of trainees
d. Have used this method, but rarely
e. Never used this method

Figure 10 reflects selected Trainers' responses to frequency of use of *Computer-assisted instruction (CAI).*

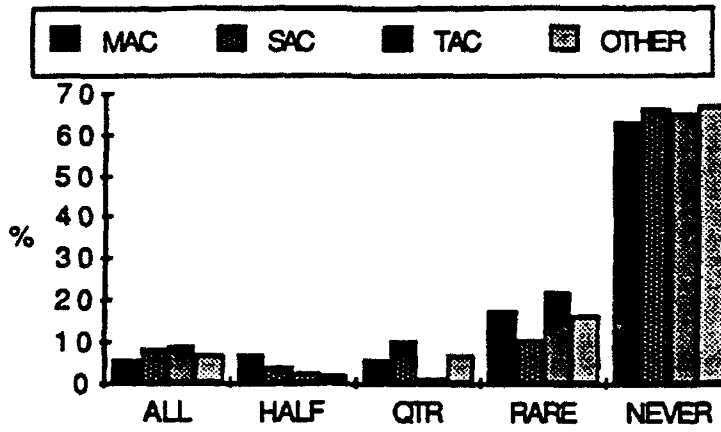



Figure 10. Use of CAI

As can be seen, little use of CAI is reported.

The following question was among those asked of Trainers on the survey:

Q. 57: When technologies for training delivery (e.g., automated systems) are introduced in our unit, they are used to full capacity.

a. Strongly agree
b. Agree
c. Disagree
d. Strongly disagree
e. Not applicable or don't know

Figure 11 portrays the responses of selected Trainers.

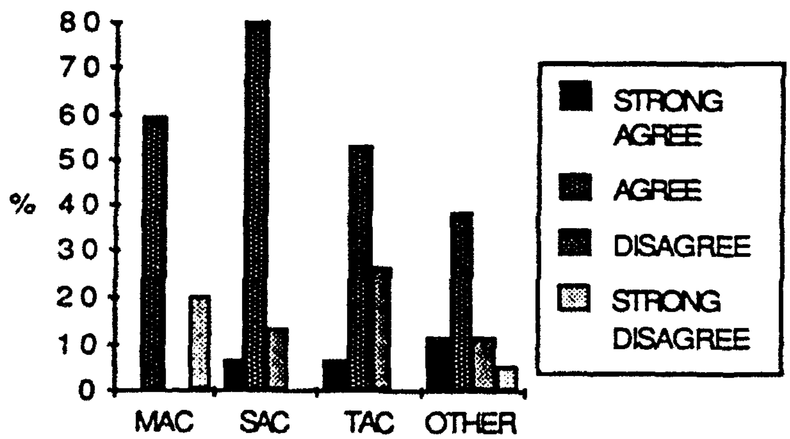



Figure 11. Selected Trainer Responses to Question 57

Figure 12 collapses the responses into the generic "Agree" or "Disagree" categories to get a clearer view.

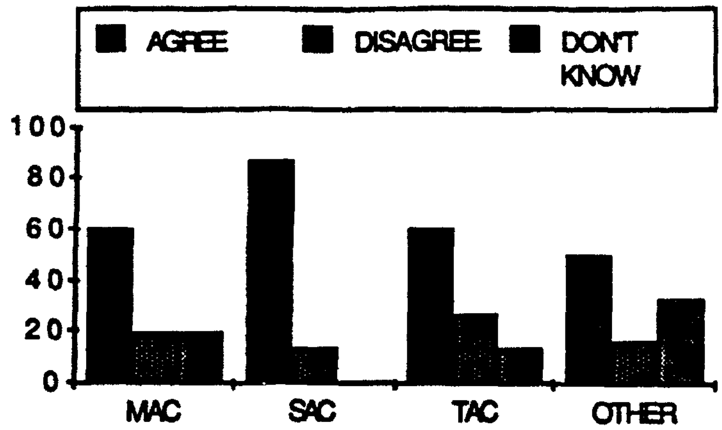



Figure 12. Collapsed Responses to Trainer Question 57

SAC, by far, shows the strongest agreement, and TAC the strongest disagreement that training technologies are used to full capacity in their units.

The following question was among those asked of Trainers on the survey:

Q. 59: Computer-assisted training technologies can be as effective as classroom training.

a. Strongly agree
b. Agree
c. Disagree
d. Strongly disagree
e. Not applicable or don't know

Figure 13 portrays the responses of selected Trainers.

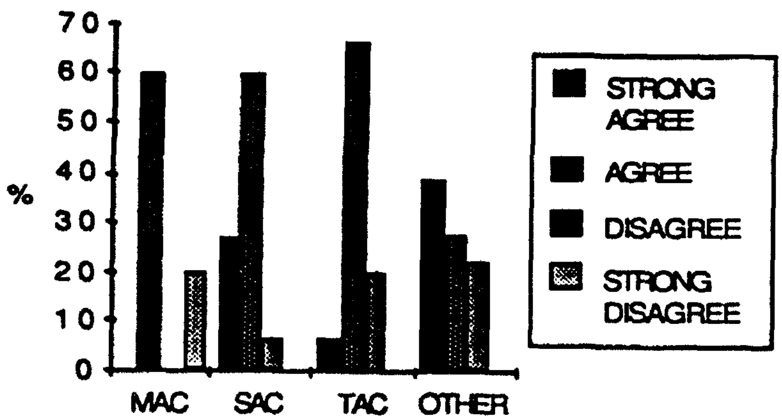



Figure 13. Selected Trainer Responses to Question 59

Figure 14 collapses the responses into the generic "Agree" or "Disagree" categories to get a clearer view.

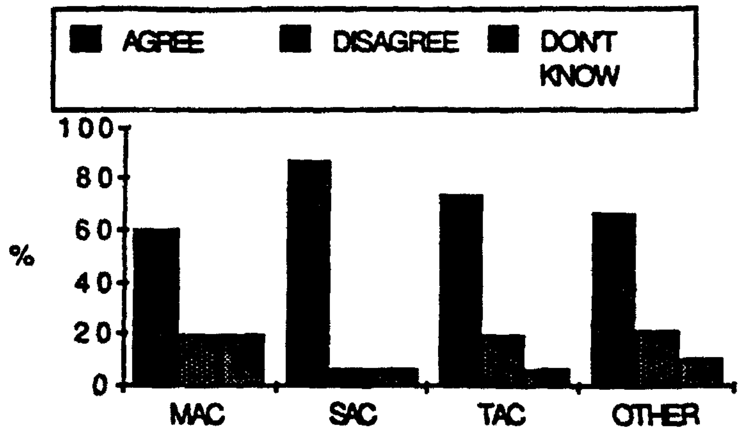



Figure 14. Collapsed Responses to Trainer Question 59

SAC, once again, shows the strongest agreement, with other commands showing about equal disagreement.

**It seems clear that Trainers in SAC are the strongest supporters of computer-assisted instruction among the large MAJCOMs.**

**Trainee Significant Findings Regarding Degree of Automation**

The following question was among those asked of Trainees on the survey:

Q. 21: For each method of training listed, please use these responses to indicate whether you would prefer more or less of this method of training in the future.

- a. Prefer much less of this method of training
- b. Prefer slightly less of this method of training
- c. Present use of this method is about right
- d. Prefer slightly more of this method of training
- e. Prefer much more of this method of training
- f. Did not experience this method, or do not know

Figure 15 reflects selected Trainees' responses to individual training using *Computer-based instruction (CBI).*

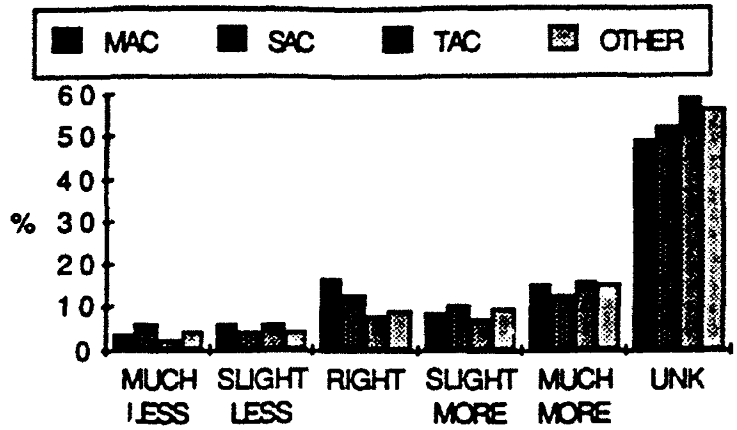



Figure 15. Selected Trainee Responses to Question 21

Figure 16 collapses the responses into the generic "More" or "Less" categories to get a clearer view.

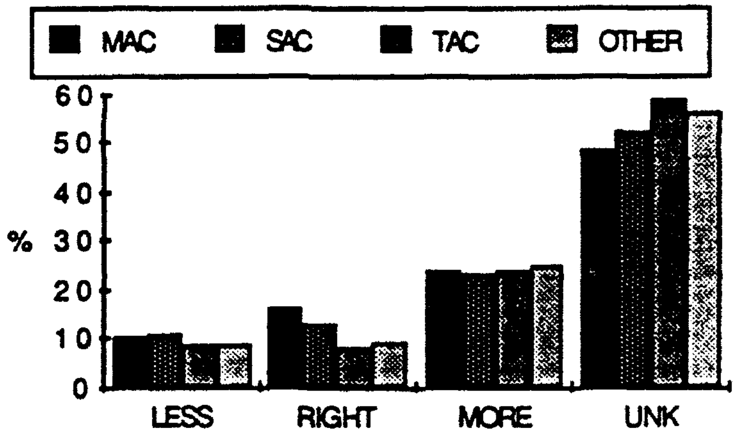



Figure 16. Collapsed Responses to Trainee Question 21

**Of those who express an awareness of CBI, there is a uniform indication that more CBI use is desired by Trainees.**

**Time Spent on Training Duties by Training Managers versus Degree of Automation**

The following questions were among those asked of Training Managers on the survey:

Q. 9: About what portion of your duty time is spent on scheduling?

a. All or nearly all
b. About three-quarters
c. About half
d. About one-quarter
e. About 5 to 10 percent
f. Less than 5 percent

Q. 10: How would you describe the systems you currently use to do your scheduling?

a. Fully automated
b. Automated scheduling from manual input
c. Manual scheduling from automated input (source documents)
d. Fully manual

Figure 17 plots question 9 against question 10.

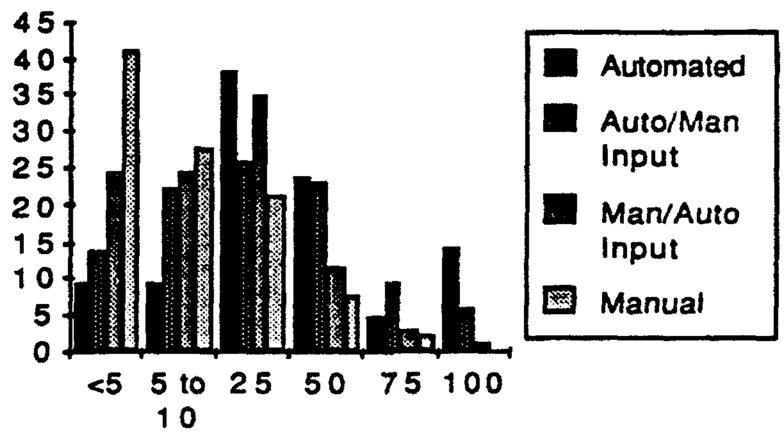



Figure 17. Time Spent Scheduling vs. Degree of Automation

These data indicate that those Training Managers using automated *scheduling* methods tend to spend more time on the activity of *scheduling* than do those using manual methods. Since this is counterintuitive, further investigation was undertaken.

When looking at time spent on *scheduling* by types of units, we fir d that high time is reported by Training Managers in Aircraft Maintenance, Medical, Services, Training Units, and Other. When looking at degree of automation in *scheduling* systems by types of units, we find a relatively high degree of automation reported by Training Managers in Aircraft Maintenance, Communications, and Training Units. A relatively low degree of scheduling automation is reported by Training Managers in Civil Engineering.

**It would appear that Aircraft Maintenance and Training Units are the largest contributors to the "high time/high automation" phenomenon for *scheduling*.**

The following questions were among those asked of Training Managers on the survey:

Q. 25: About what portion of your time is normally spent on documentation?

a. All or nearly all
b. About three-quarters
c. About half
d. About one-quarter
e. About 5 to 10 percent
f. Less than 5 percent

Q. 26: How would you describe the system you currently use to document completed training?

a. Fully automated
b. Partially automated
c. Fully manual

Figure 18 plots question 25 against question 26.

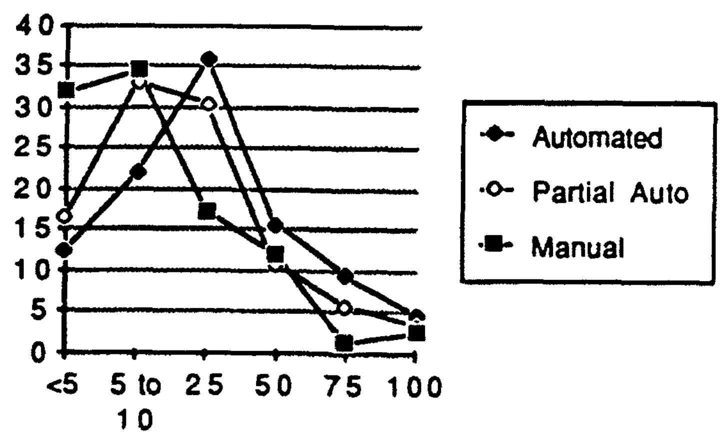



Figure 18. Time Spent Documenting vs. Degree of Automation

These data also indicate that those Training Managers using automated *documentation* methods tend to spend more time on the activity of *documenting* than do those using manual methods. Again, since this is counterintuitive, further investigation was undertaken.

When looking at time spent on *documentation* by types of units, we find that high time is reported by Training Managers in Training Units, Communications, Civil Engineering, and Other. When looking at degree of automation in *documentation* systems by types of units, we find a relatively high degree of automation reported by Training Managers in Training Units, Communications, and Other. A relatively low degree of automation is reported by Training Managers in Civil Engineering.

**It would appear that Training Units, Communications, and Other are the largest contributors to the "high time/high automation" phenomenon for *documentation*.**

We next examined time spent and degree of automation in *documentation* by MAJCOM. (Tests of significance relative to *scheduling* did not make examination of that aspect by MAJCOM appropriate.)

Figure 19 portrays documentation times reported by Training Managers from MAC, SAC, TAC, and Other.

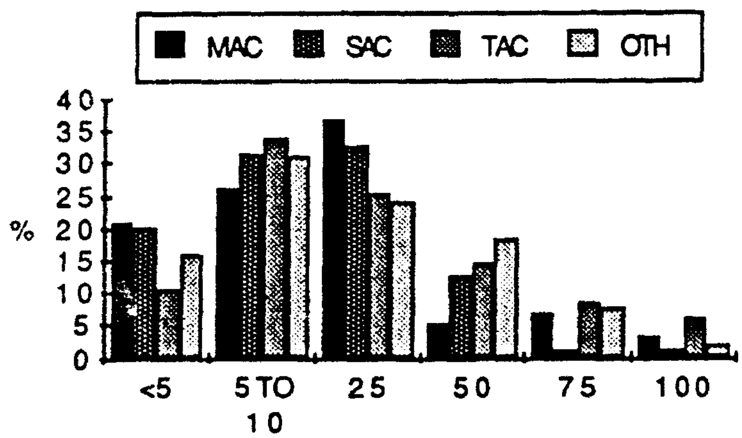



Figure 19. Time Spent by Training Managers in Documentation

Note the lesser amount of time reported by SAC Training Managers in *documentation*.

We then examined *documentation* methods reported by Training Managers by MAJCOM. The "big four" data are shown in Figure 3-20.

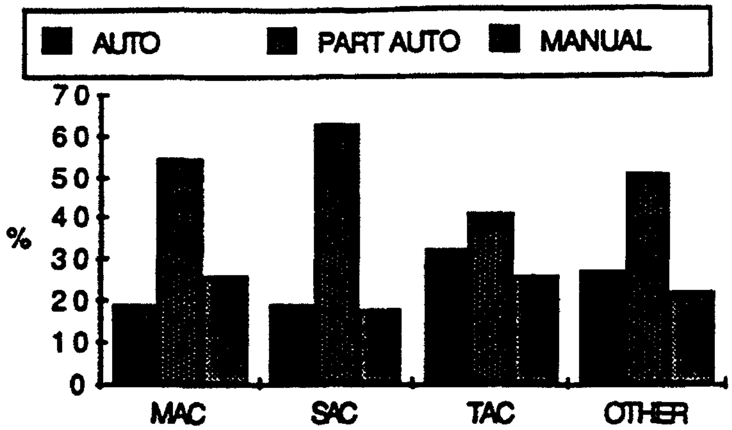



Figure 20. Degree of Automation in Documentation Methods

Note the high use of partial automation reported by SAC for *documentation.*

**Based on the conclusion that SAC appears to be relatively efficient in the use of at least partial automation (low time/high automation), it is suggested that their methods be studied in more detail for possible use as a "technology baseline." Further investigation is also warranted of those "high time/High automation" activities identified earlier.**

Problems Identified by Trainers

In questions 11 to 20, respondents were given various aspects of OJT training and were asked to use the following scale to rate each aspect:

a. Not a problem at present -- no improvement needed.
b. Only minor problems with this at present.
c. Some problems with this -- improvement desirable.
d. Major problems with this -- improvement urgently needed.

Figure 21 reflects the distribution of responses from all Trainers responding to the survey. (Refer to Appendix B-2 for descriptions of each aspect of OJT training addressed.)

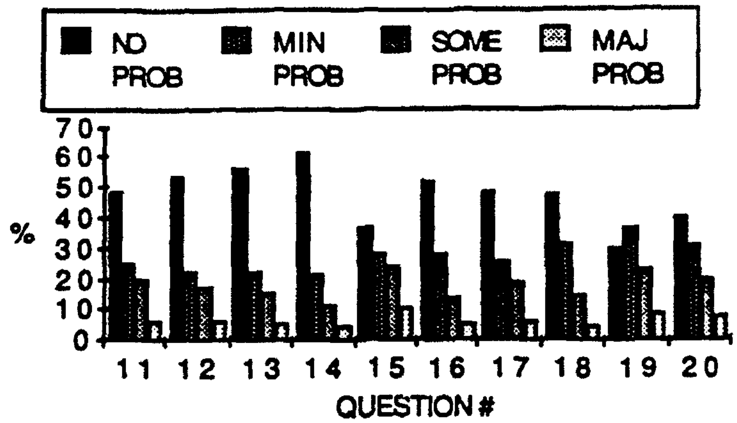



Figure 21. Magnitude of Problems

Figure 22 collapses the responses from the previous figure into two responses for each question -- "No and Minimum Problems" into one, and "Some and Major Problems" into another.

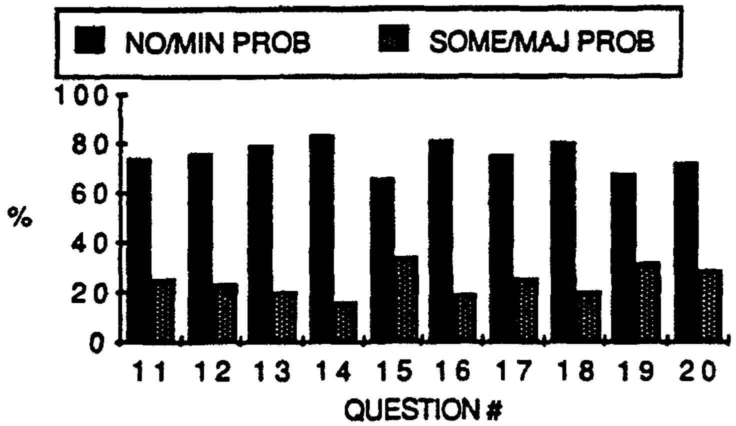



Figure 22. Problems/No Problems

As can be seen, more problems are reported with questions 15, 19, and 20 than others. These questions are:

Q. 15: Having enough time to perform my training duties.
Q. 19: Training on tasks that are not performed very often.
Q. 20: OJT keeping up with changes in technology used for the job.

Figure 23 portrays the percentages of the "Major Problems" responses.

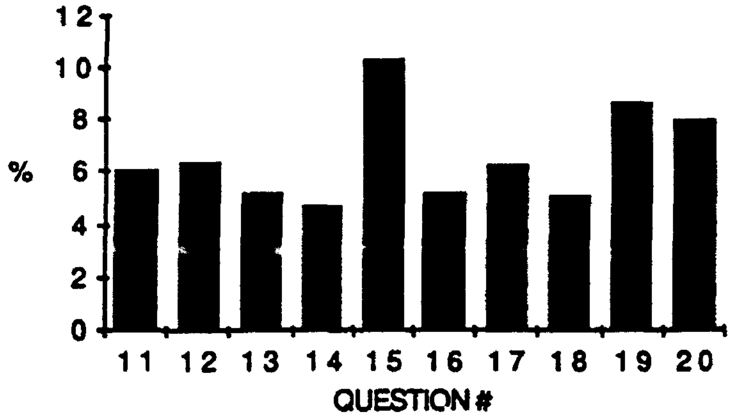



Figure 23. Major Problems

Again, we see that most major problems are reported to be with questions 15, 19, and 20.

We then examined each of these questions by responses received from Trainers in MAC, SAC, TAC, and "Other" (essentially USAFE and PACAF).

Figure 24 portrays the responses to question 15 (Having enough time to perform my training duties). Chart 1 reflects all responses, and Chart 2 collapses the responses into two responses -- "No and Minimum Problems" as one, and "Some and Major Problems" as another.

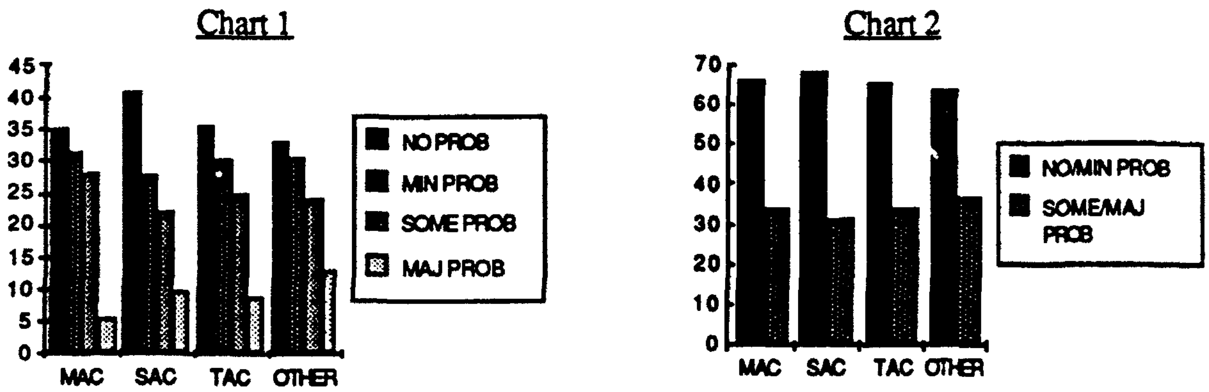



Figure 24. Selected MAJCOM Responses to Question 15

As can be seen the magnitude of problems with question 15 varies little by MAJCOM.

Figure 25 portrays the responses to question 19 (Training on tasks that are not performed very often). Chart 1 reflects all responses, and Chart 2 collapses the responses into two responses -- "No and Minimum Problems" as one, and "Some and Major Problems" as another.

Chart 1 | Chart 2

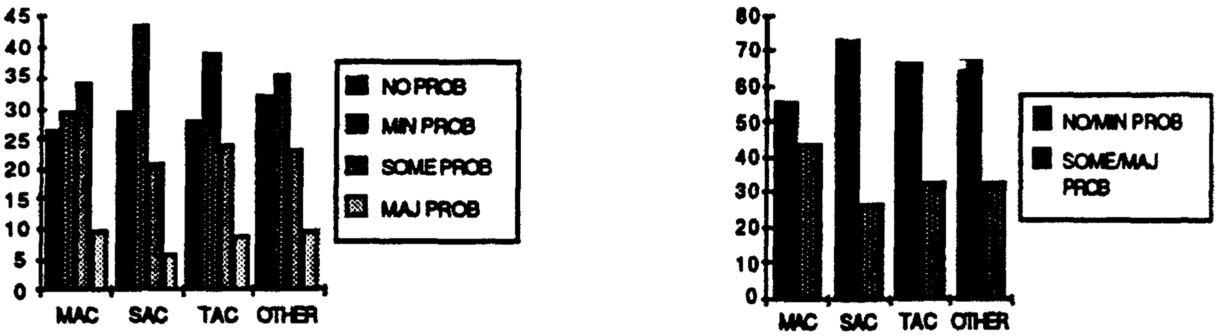



Figure 25. Selected MAJCOM Responses to Question 19

It would appear that MAC, especially, experiences some problems with training on tasks that are not performed very often.

Figure 26 portrays the responses to question 20 (OJT keeping up with changes in technology used for the job). Chart 1 reflects all responses, and Chart 2 collapses the responses into two responses -- "No and Minimum Problems" as one, and "Some and Major Problems" as another.

Chart 1 | Chart 2

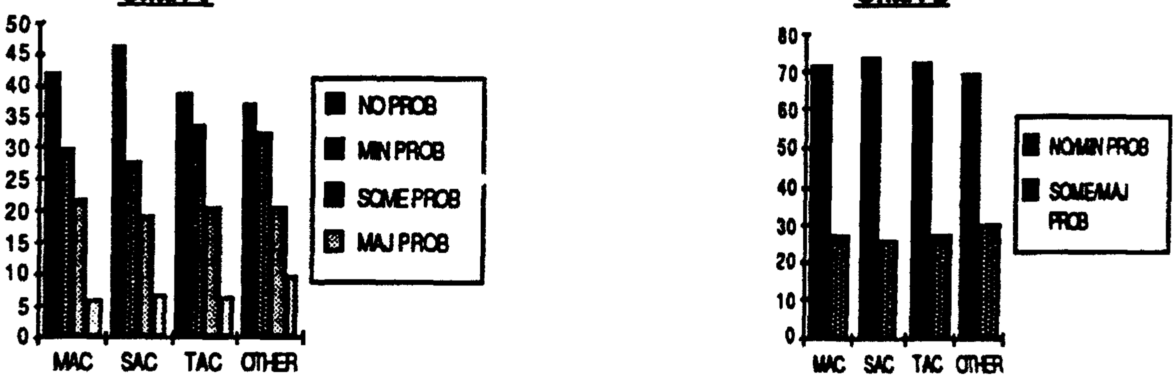



Figure 26. Selected MAJCOM Responses to Question 20

As can be seen, the magnitude of problems with question 20 varies little by MAJCOM.

We then examined the percentages of Trainers in selected MAJCOMs who reported that major problems exist with aspects of training addressed in questions 15, 19, and 20. Figure 27 portrays those responses.

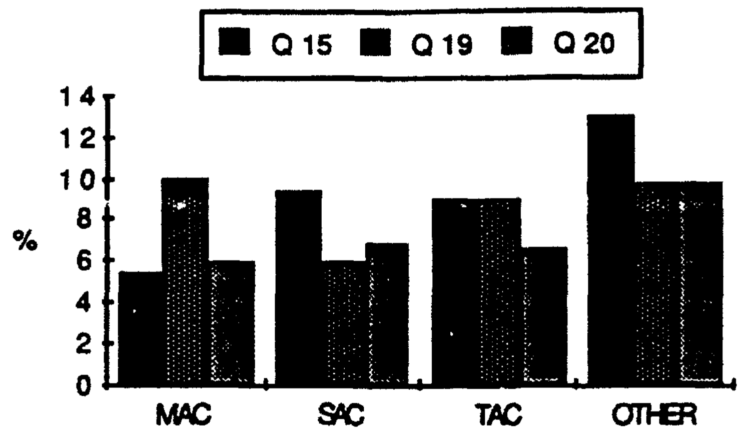
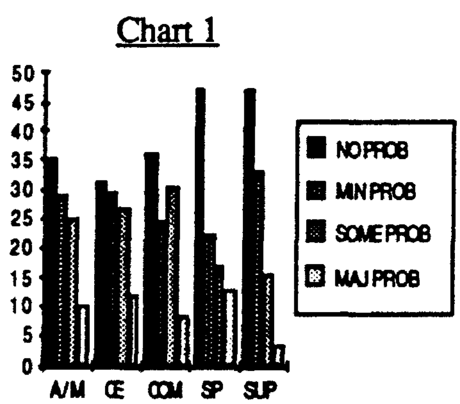



Figure 27. Percent of Trainers Who Reported Major Problems by MAJCOM

Overall, indications of the existence of major problems are minimal, and their magnitudes vary by MAJCOM. In general, overseas respondents ("Other") seem to perceive more major problems than do CONUS respondents.

We then examined the responses provided to questions 15, 19, and 20 by Trainers in selected types of units, specifically Aircraft Maintenance, Civil Engineering, Communications, Security Police, and Supply units.

Figure 28 reflects responses to question 15 from these Trainers. Chart 2 collapses the responses from Chart 1 into two responses for question 15 -- "No and Minimum Problems" into one, and "Some and Major Problems" into another.



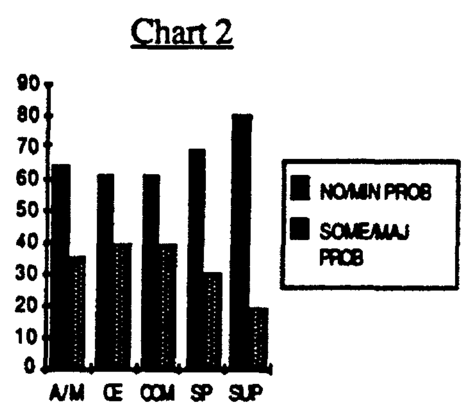




Figure 28. Selected Unit Responses to Question 15

As can be seen, the magnitude of problems with question 15 varies somewhat by type of unit, with Trainers in Supply reporting the least problem with finding time to perform training duties.

Figure 29 reflects responses to question 19 from Trainers in Aircraft Maintenance, Civil Engineering, Communications, Security Police, and Supply units. Chart 2 collapses the responses from Chart 1 into two responses for question 15 -- "No and Minimum Problems" into one, and "Some and Major Problems" into another.

Chart 1

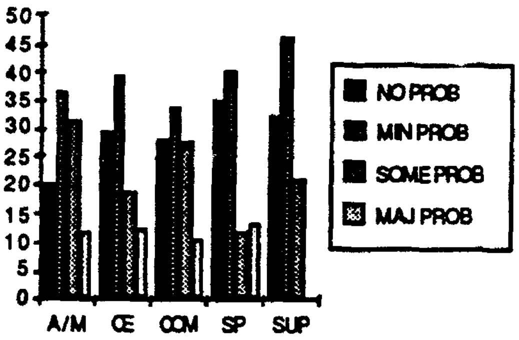



Chart 2

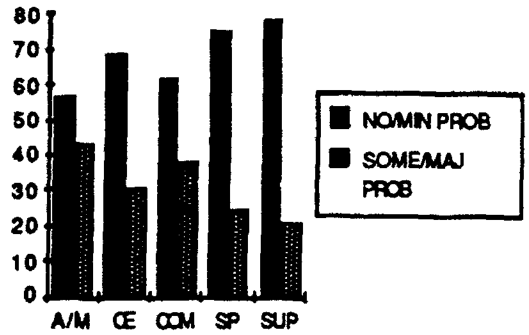



Figure 29. Selected Unit Responses to Question 19

It would appear that Trainers in Aircraft Maintenance experience the most problems with training on tasks that are not performed very often, and Trainers in Supply experience the least problem with this.

Figure 30 reflects responses to question 20 from Trainers in Aircraft Maintenance, Civil Engineering, Communications, Security Police, and Supply units. Chart 2 collapses the responses from Chart 1 into two responses for question 15 -- "No and Minimum Problems" into one, and "Some and Major Problems" into another.

Chart 1

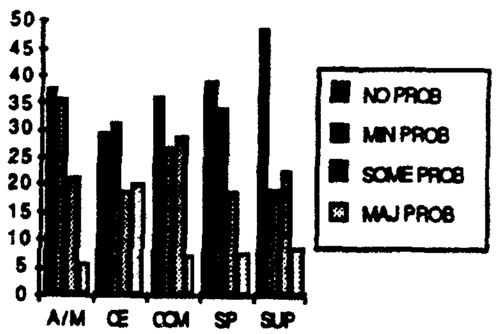



Chart 2

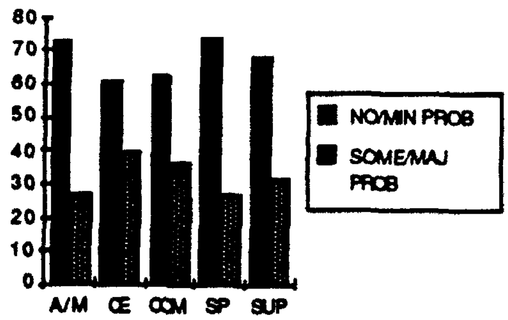



Figure 30. Selected Unit Responses to Question 20

As can be seen, the magnitude of problems with OJT's ability to keep up with changes in technology does not vary greatly by type of unit, although Civil Engineering experiences more problems than others.

We then examined the percentages of Trainers in selected units who reported that major problems exist with aspects of training addressed in questions 15, 19, and 20. Figure 31 portrays those responses.

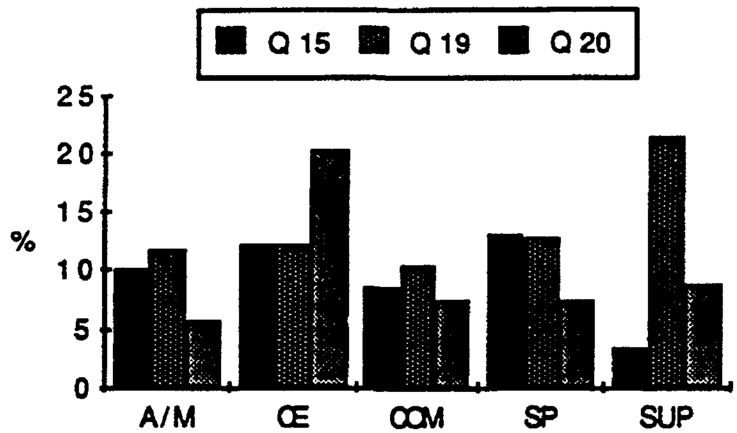



Figure 31. Percent of Trainers Who Reported Major Problems by Unit Type

Overall, indications of the existence of major problems are minimal, and their magnitudes vary by type of unit. Reasons for perceived major problems by Trainers in Civil Engineering regarding question 20, and Trainers in Supply regarding question 19 appear worthy of further examination.

## Interview Significant Findings

Copies of the interview instruments used for the telephone interviews may be found at Appendix C. Following are the significant findings regarding training documentation, training methods, and potential for expanded unit level training.

### Significant Findings Regarding Training Documentation

The most frequently mentioned problems with training documentation were:

- Keeping documentation current and accurate. (Mentioned by 36.4% of the Training Managers, and 17.5% of the Trainers.)

- Takes too much time. (Mentioned by 24.2% of the Training Managers, and 20% of the Trainers.)

- It is paperwork-intensive. (Mentioned by 18.2% of the Training Managers, and 20% of the Trainers.)

These problems, taken in combination, indicate that training documentation has great potential for further automation.

### Significant Findings Regarding Training Methods

When asked what training methods are used in their unit, there was considerable agreement between Training Managers, Trainers, and Trainees with regard to the use of self-study materials, operational equipment, classroom instruction, videotapes, and simulators/mock-ups. However, as can be seen in Table 4, there was considerable disagreement in perceptions as to the use of computer-based training (CBT), non-operational equipment, and interactive video disk (IVD).

Table 4. Training Methods Used in Unit

| Method | Trng Mgr | Trainer | Trainee |
|---|---|---|---|
| CBT | 55.3% | 17.5% | 40.0% |
| Non-operational Equipment | 42.1% | 37.5% | 87.5% |
| IVD | 17.5% | 17.5% | 7.5% |

Training Managers and Trainers were asked, "Are there any training technologies that are not available to you that would benefit your training program or activities?" Forty-five percent of Training Managers and 35 percent of the Trainers responded in the affirmative. Of those, the percentages shown in Table 5 specified the cited technologies.

Table 5. Desired Technologies

| Position | CBT | IVD |
|---|---|---|
| Training Manager | 70.6% | 47.1% |
| Trainer | 35.7% | 42.9% |

This is a fairly strong statement of support and desire for expanded use of training technologies, especially for CBT.

**Significant Findings Regarding Potential for Expanded Unit Level Training.**

Although concerns were expressed regarding any proposed reduction in ATC resident training, 63% of the Training Managers and 60% of the Trainers interviewed indicated that training levels could be increased at the unit level without a negative impact on operational capability. Their opinions varied considerably as to the magnitude of the capacity to expand; however, most responses clustered between 25 and 50 percent.

**Interviews of Desert Storm/Desert Shield Participants**

All interviewees were asked if they participated in either Desert Storm or Desert Shield, or both. The research team hoped to obtain useful data regarding training in a wartime environment. Unfortunately, the very small population interviewed, particularly those who deployed to the Middle East (see Table 6), did not allow the team to draw any meaningful conclusions.

Table 6. Desert Shield/Storm Participants

| | Trng Mgrs | Trainers | Trainees | Total |
|---|---|---|---|---|
| Total Participants | 12 | 18 | 2 | 32 |
| Number Who Deployed | 1 | 15 | 0 | 16 |
| Deployed to Middle East | 1 | 9 | 0 | 10 |

**Summary of Significant Survey and Interview Findings**

- Only 30 percent of Trainers are instructor-qualified.
- Use of training technologies is limited in most MAJCOMs and units.
- In terms of use and support of automated training systems in general, Training Managers and Trainers in what was SAC far out-pace the other MAJCOMs.
- By type of unit, it appears that Aircraft Maintenance is the most automated in its training systems, and Civil Engineering the least.
- More use of computer-assisted instruction is desired by Training Managers, Trainers, and Trainees.

- Training Managers who use automated scheduling and documentation systems tend to report more time spent on these activities than do Training Managers using manual systems. This phenomenon could not be fully explained through analysis of data collected. It occurs largely in Aircraft Maintenance, Communications, and Training Units. In documentation, particularly, it may be that those with automated systems feel "forced" to use them, whereas, since AFR 50-23 (Enlisted Specialty Training) does not "dictate" much in the way of documentation requirements, those without an automated documentation system do not spend as much time performing this activity.

- The most significant problems identified by Trainers are:

  - Not having enough time to perform training duties.

  - Conducting training on tasks that are not performed very often.

  - OJT's inability to keep up with changes in technology used for the job.

Possible solutions to these problems/issues will be addressed in the next section of this report.

# IDENTIFICATION OF PROJECTS TO ADDRESS SLT NEEDS

## Current Projects

Many of the research efforts currently being conducted or planned by AL/HR address various aspects of the most significant concerns and needs identified through the surveys and interviews. These needs should be addressed in order to enhance or improve squadron level training capabilities. These were:

- Only 30% of OJT trainers are instructor qualified.
- Time spent on documentation and scheduling is excessive.
- Need to improve the currency of training.
- Need to increase the amount of time OJT trainers have to train.
- Need methods for addressing training on tasks seldom performed.

The following research efforts were reviewed to determine which could have some impact in addressing the concerns and needs listed above.

Table 7. On-going Research Efforts

| | | |
|---|---|---|
| Advanced Instructional Design Advisor (AIDA) | Computer-Based Training Selection and Implementation Strategies | Job Performance Measurement (JPM) |
| Advanced On-the-Job Training System (AOTS) | Fundamental Skills Training (FST) | Logistics Command and Control |
| Advanced Training System (ATS) | Instructional Support System (ISS) | Multi-Task Trainer Research (MTTR) |
| Aircrew Combat Mission Enhancement (ACME) | Integrated Maintenance Information System (IMIS) | Part Task Trainers (PTT) |
| Basic Job Skills | Intelligent Tutoring Systems (ITS) | Task Analysis for Tactical C2 (TATC2) |
| C-130 Aircrew Training System Evaluation (ATSE) | Job-Aiding/Training Analysis Technologies (JATAT) | Training Assessment Technologies |
| Comprehensive Occupational Data Analysis Program (CODAP) | | Training Decision Modeling Technologies (TDMT) |
| | | Training System for Maintenance (TRANSFORM) |

## Using the ISD Framework

Of the projects reviewed, those identified as having some direct relevance to the SLT needs identified were then compared against ISD categories using the methodology developed in Phase I of the SLT project. The majority of classifications given were done by HRTC and HRTI of the Armstrong Laboratory, at the request of HRTE. Table 9 at the end of this section gives the areas of the ISD framework addressed by the research projects.

Using the ISD classifications as a guide, the selected projects were analyzed to determine what these projects could contribute to squadron level training. The projects analyzed did not have to specifically address or focus on squadron level training, rather projects were considered relevant if they provided a methodology, product or any findings that could be applied to SLT needs.

## Current Research with Applications to SLT

The following are brief descriptions of the salient (SLT related) aspects of the research efforts with comments on how they may impact squadron level training.

Advanced Instructional Design Advisor (AIDA). This research is exploring the automation of an instructional design system which would guide course developers through the instructional design process. The system would be derived from empirically sound and theory-based instructional models.

> Comment. The automation of instructional design could favorably impact the currency of training. If the approach is very user friendly it could provide assistance to squadron level training development by providing guidance in materials development.

Base Training System (BTS). This program will integrate training development, delivery, evaluation, and management to provide an automated squadron-level technology for systematic and effective job-site training. The production version of this technology is currently focused on management functions.

> Comment. This technology could help address identified concerns regarding the currency of training, time available for training, and issues of tasks seldom performed. The implementation of the BTS part of this project may help reduce the documentation problem.

Advanced Training System (ATS). This CBT development and support package is an integrated CBT and support system using distributed architecture for development, delivery, evaluation, and management of training at ATC resident technical training wings. ATS has the potential to be the foundation for all CBT, simulators, and part-task trainers.

Comm nt. The instructional development, delivery, management, and evaluation subsystems developed under this effort could be applied to SLT. One factor that has to be considered is the current lack of skills at the squadron level in the development of CBT, simulators, or part-task trainer development. The development aspects of this system would be limited because of the lack of skills at the squadron level in training development.

Basic Job Skills. This project is developing an integrated cognitive task analysis/training development technology to build adaptive training directed at the fundamental mental skills required in the AF's most technologically advanced enlisted occupations. The goal is to train the complex problem solving skills that accelerate the growth to competence and to knowledge flexibility in high-tech work centers by capturing the collective maintenance knowledge of expert technicians. The expert knowledge base is then transformed into learnable curricula for novice technicians.

Comment. This expert system could be applied to the development of expert systems based programs to train OJT instructors, provide basic instruction and thereby allow OJT trainers to focus on the more technically difficult tasks, and also provide the "shell" for job aids for tasks seldom performed.

Comprehensive Occupational Data Analysis Program (CODAP). This package of computer programs is used to input, process, organize, and report occupational data from job inventories. CODAP manipulates and reports task-level and biographical survey data gathered from job incumbents and expert raters for the purpose of identifying and analyzing current job structures and task characteristics within a target occupational area.

Comment. This system can also be used to collect and analyze data on OJT instructor needs, help determine if training is current by comparing CODAP findings against training materials, and identify those tasks that are seldom performed.

Computer-Based Training Selection and Implementation Strategies. This effort will develop guidelines for selecting and applying CBT technologies to training. The products will help guide the selection of existing courses for conversion to CBT.

Comment. At the squadron level, such guidelines could help Training Managers and Trainers identify information that can be effectively presented through CBT. The information can then be presented to developers.

Instructional Support System (ISS). This project will produce a user friendly computer-based training and management system that can be used by Trainers at the squadron level to develop CBT for their own use and shared with other units.

Comment. The development of a user friendly authoring system may have only minimal effect at the squadron level due to the lack of training development training or experience.

Integrated Maintenance Information System (IMIS). This effort will produce a tool to provide in-depth training for maintenance technicians through a portable digital text and graphics display job aid. This electronic job aid can be hand-carried to present the required information at the job site.

Comment. The IMIS can have a direct impact on tasks seldom performed and overall training. Though the portability aspect may not be essential for many non-maintenance jobs, the concepts and structure of the programming may well prove beneficial to the development of training tools and job aids outside of the maintenance career fields.

Intelligent Tutoring Systems (ITS). This effort is intended to provide effective, low cost, transportable training for individualized instruction in specific high technology areas. ITS authoring and delivery capabilities will result from the Intelligent Computer Assisted Training Testbeds (ICATT) project.

Comment. The use of artificial intelligence based systems for the development of adaptive training based systems would appear to be a natural outgrowth of the use of AI based programs for training development. It may well enhance the quality of CBT by incorporating adaptive training techniques. No theoretical reason exists for not using the ITS for less technical occupations. Training would need to be developed centrally and then provided to the units.

Job-Aiding/Training Analysis Technologies (JATAT). This project will provide methods for deciding whether and how tasks should be trained, job-aided, or some combination of the two, and provide human and system performance models to evaluate those decisions.

Comment. This could be used at the squadron level to systematize the training process, and thereby allow Trainers to focus on more technically difficult tasks.

Job Performance Measurement (JPM). This program is developing methods for measuring individual job performance to validate selection/classification tests, evaluate training systems/programs, and evaluate research products.

Comment. In order to assure that training at the squadron level is achieving its desired goal, measurement of job performance is critical. The evaluation of training against actual job performance is a much more desirable and accurate indicator of training effectiveness than the use of some intermediate factor of training effectiveness such as end of course assessments.

Multi-Task Trainer Research (MTTR). This effort is based on Air Intercept Trainer technology and will provide emergency procedure training in flight safety. It will have authoring capabilities so that non-programmers can quickly and easily modify course content to provide up-to-date training.

Comment. Though the content of the training will be useful for a segment of the squadron level population, the approach used for ease of updating content could well influence the design of other CBT efforts if it proves to be easily transportable and not related to characteristics of the subject matter.

Part Task Trainers (PTTs). The PTT provides low cost, off-the-shelf, easily upgradeable simulator training systems. PTTs would permit frequent practice of mission critical tasks at the squadron level.

Comment. The reduction of cost and improving the ability of part task trainers to be upgraded could expand the use of simulator training systems into areas where cost has been prohibitive and where rapid changes in technology have made simulators impractical. Reduction in cost of PTTs would permit the Air Force to increase the number and availability of simulators at the base and squadron level which could in turn reduce the amount of time personnel spend at formal technical schools. PTTs with the characteristics of low initial cost and ease of upgrade have the potential of becoming integral to squadron level training.

Training Impact Decision System (TIDES). The findings of this effort will allow Training Managers to make better decisions about the what, when, and where of training. Decisions could be made that focus on squadron level training needs.

Comment. TIDES is primarily a high level decision support system for use by functional managers of career fields. It is possible that future applications could focus on squadron level training issues. This could prove a useful tool by giving Training Managers better information on the decisions they need to make.

Training System for Maintenance (TRANSFORM). The system developed will be used by Instructional Systems Developers in developing maintenance training for new weapon systems. The TRANSFORM products will be used by Field Training Detachments. The system, which provides an automated interface between the Logistics Support Analysis process and Instructional Systems Development, is being used as a prototype in a Joint Service Decision Support System.

Comment. This system could well have a positive impact on the currency of training at the squadron level. Consideration should be given to expanding the application of this technology to other than weapons systems.

## Additional SLT Focused Research

The needs identified as the highest priorities by the SLT research diverge somewhat from the areas of focus of the current projects at Armstrong Laboratories. The following section deals with the identification of research efforts that specifically address the major issues identified in the surveys and interviews conducted.

ISSUE ONE: Only 30% of OJT trainers are instructor qualified.

The number of OJT instructors that are instructor qualified was surprisingly low. The concern here is not a question of credentials, rather it is a matter of training knowledge. OJT trainers may well possess specific technical knowledge in a field, yet know nothing about how to train. Without some form of training, OJT trainers must of necessity fall back on what they remember of how they were trained or use the "discovery method," that is figuring it out for themselves. This may or may not lead to successful training.

OJT is the foundation of squadron level training. And the OJT instructor is the single most important factor in the delivery of quality training at the squadron level. Although the importance of the OJT instructor is recognized as critical, for the vast majority of OJT instructors, instruction is a secondary task.

Given the realities of the work environment, a training method needs to be:

- Available on the job site on demand.
- Able to provide what the trainer needs to know in a manner that is understandable and effective.
- Flexible enough to fit any job environment.
- Implementation and maintenance costs must be very low.

Several methods to address this issue were considered:

- CBT for the trainer.
- Use of distance learning.
- Expert Systems training guidance.
- Enhanced expert/professional support (better Training Managers).

Of those listed, two are implementable within a relatively short period of time and at low cost. These are:

- CBT for the trainer (OJT-Trainer CBT); and
- Expert System training guidance (Expert Trainer).

Computer Based Training. A CBT program can be developed at relatively low cost using technology available today. Given the widespread availability of DOS-

based computers throughout the Air Force for use as platforms, the use of CBT is desirable. A course can be shipped worldwide on a few disks and can be maintained at substantially less cost than paper-based training materials.

Much of the current research presently conducted by AL/HR is focused on Computer Based Training. The Computer-Based Training Selection and Implementation Strategies, Instructional Support System, Intelligent Tutoring Systems, Multi-Task Trainer Research, and Part Task Trainers, all take advantage of the computer environment as a modality of training delivery. A research effort to develop a CBT program for OJT instructor training could take significant advantage of existing findings and expertise. To develop a low cost OJT-Trainer CBT program should not take more than a year to research and develop a prototype.

General Background and Concepts of CBT. Computer based instruction takes many forms: text with graphics, interactive video disk (IVD), compact-disc based systems (CD-ROM, CD-I), digital video interactive (DVI) and others. But no matter how sophisticated, the key element of all these systems is that they take advantage of the computer's ability to manipulate different *types* of information -- audio, video, graphics, animation, text -- in an *interactive* learning situation.

The differences between the various types of CBI systems lies largely in their particular selection of information types, e.g., some systems emphasize sound capabilities, others focus heavily on graphics. Because of this mixing of various forms of information, these systems are often referred to as interactive *multimedia* systems. Although the word multimedia is a vague term that is often misused, it is effective in describing the direction in which CBI is heading.

As multimedia technologies become more sophisticated, and CBI developers anticipate the integration of video into their presentations, those that are worth their salt have already begun to seriously consider the audio and visual aspects of CBI. The increasing capability of moderately priced computer hardware to effectively handle complex graphic representations and audio output will allow developers to move from printed text type descriptions of an activity to a more naturalistic situation where the student can listen to the abstract concepts while viewing the concrete. Unlike classroom lectures, the auditory information is not lost in the computer environment, but is as permanent as any text presented in a program.

Furthermore, the notion of *interactivity* has been heralded as the key factor in making computer based instruction an effective teaching instrument. However, there are some fundamental misconceptions about interactivity that have resulted in scores of weak learning programs.

Before designing a CBI program, the question that must be asked is: "what will be lost in translating this content material from a classroom environment to an individualized system?" Many developers responded to this translation by

creating CBI programs that both prompted the user with commands like *"PRESS ANY KEY TO CONTINUE"* and posed multiple choice questions, believing that the result was an interactive program.

However, the true nature of interactivity is much deeper than this. The interactive relationship between student and teacher in a classroom environment is *intellectual.* This type of interactivity cannot be replicated in a CBI by simply forcing the student to push buttons on a keyboard.

The true interactive relationship of a classroom environment is recreated *only by implanting this interactivity in the content of the subject matter.*

**Expert Systems.** An Expert System consultation using existing artificial intelligence programming languages such as ProLog or M1 that will run on existing platforms, can be developed relatively quickly. The OJT trainer would use such a system in a consultative manner, accessing expert advice when needed.

The development of an OJT-Trainer CBT, or an Expert Trainer will require basic research to identify OJT training methodologies that are easily learned and can be applied quickly by non-professional trainers. The Intelligent Tutoring Systems project can provide an existing base for the development of the Expert Trainer. This, like the previously discussed OJT-Trainer CBT, could be a relatively "fast turnaround" project. The major technical hurdles would be content related rather than the mode of delivery. Such an effort may take from twelve to eighteen months.

Some of the issues that need to be addressed are: What are the most common individual problems of learners? What methods can be used to address these problems? How much does the OJT trainer need to know in any one area (depth of training) in order to be effective?

**General Background and Concepts of Expert System.** Expert Systems are a direct result of research in the field of artificial intelligence. They can help solve complex problems that previously required the aid of a human expert with years of experience. And they can do it with the speed and recall that only a computer provides.

Expert Systems are typically designed around a **Knowledge Base** of **FACTS** and **RULES** relating to a particular task or application, and an **Inference Engine** that performs the reasoning process to solve specific problems in that application area. Once an expert system is developed and fielded, computer users can engage in question-and-answer consultations with the system about a problem or factors pertinent to the application.

Typically these systems have a natural language interface which makes the knowledge contained in these programs accessible to almost anyone. Expert Systems make knowledge accessible in a useful form even when the human

expert is not physically present. Expert Systems can allow a novice to function "as if" he or she were an expert within a specific domain.

An Expert System is very different from computer programs that supply strict factual knowledge such as the word processing spell checkers or a simple question and answer program. An Expert System models the problem solving approach of an expert. An expert system is not something that can be used to solve new or novel problems. But most problems are only new to the individual facing the problem. To experts, most problems are simply variations on a theme.

Expert Systems model experts, they do not replace them. An Expert System cannot provide information beyond the scope of the information available to it. For example, an Expert System designed to assist in troubleshooting television sets could help to troubleshoot a radio, but an Expert System designed to troubleshoot radios would be of no use troubleshooting the video components of a television.

Expert Systems use human knowledge and experience to solve problems that could otherwise be solved by an expert in a reasonable length of time. An end-user who is knowledgeable, but not an expert in a specific area, will benefit from the system's ability to perform the role of the expert. By using Expert Systems to distribute decision-making and problem-solving expertise, an organization can optimize its resources and reduce its costs. Expert Systems can enhance productivity by making this expertise available to others, helping them make decisions and solve problems effectively.

Today's most successful Expert Systems are capable of solving problems in which the knowledge needed to solve that problem is already understood, and which can be solved by an expert in a reasonable amount of time. Such problems are typically solved by an expert dividing the problem into several sub-problems and tackling each sub-problem independently.

These problems are characterized by their finite set of possible outcomes. In the problem-solving process, the optimum solution is determined with human reasoning that considers the evidence for and against possible outcomes. The steps in the reasoning process involve collating and abstracting information about the problem, relating the problem to a general class of solutions, and then selecting and defining one or more solutions.

Other Approaches Considered. Of the other possible approaches considered, enhanced professional support -- improving the skills of Training Managers in providing support to the OJT Trainer -- may require a reconceptualization of the function of the Training Manager's job. Based on interview findings, many Training Managers view themselves primarily as schedulers and documenters of training. This seems partially due to a lack of training knowledge, and to the amount of time many spend on documentation and reporting. Providing enhanced professional support may well require changes in policy regarding the

major job of the Training Manager and improvement of the documentation and reporting technology.

ISSUE TWO: Time spent on documentation and scheduling is excessive.

To reduce the time spent on documentation without reducing quality will require an attack on this problem from several directions.

The following ways of addressing the problem were considered:

- CBT user training and improved documentation.
- High level data integration of data sources.
- User friendly interface and on-line help.
- Self-checking integrated systems.

The findings described in this report indicating that Training Managers using automation for scheduling and documentation spend more time on these activities should be taken with some concern. The direction that documentation and scheduling appears to be moving in the Air Force is towards increased automation and standardization. Current efforts being implemented should increase standardization. The most immediately implementable means to address this problem would be providing computer based training on the automated documentation and scheduling systems.

Analysis of the user interface to determine if a more user friendly interface is needed and the development of user friendly interfaces could not only reduce training time, but reduce the amount of time spent on the system. An on-line help should also yield relatively large gains in time reduction with a relatively modest investment of research time and money.

Self-checking integrated systems, which would require both improvement in the programming and a high degree of integration among various data sources, could have a significant impact on the time spent on scheduling and documentation. This is viewed as a long-term high cost effort. Improving data integration and developing self-checking systems are much more complex tasks with many technical hurdles to overcome.

General Concepts and Background in Information Flow Technology. The use of computer technology to manage the flow of information in an organization can yield increased efficiency. Until recently, the only way to maintain and access large volumes of information was through the use of mainframe and minicomputer technology. This was often done at great expense with the need for unique software and dedicated machines. But today, the revolution in networking technologies has made electronic information management a possibility at the microcomputer level.

Networking software allows any number and type of computers to be linked together. At the next level, these small clusters of computers can then in turn be linked to other groups of computers through standard telephone or other cable wiring systems.

The key in allowing the interchange of information between different machines is the use of a set of pre-ordained protocols for the conversion of data to match the input requirements of each computer in the chain. These interface units use data exchange standards ordained by organizations like the American National Standards Institute, The Consultative Committee on International Telephone and Telegraph, and the Government Open Systems Interconnect Profile at the National Institute of Standards and Technology.

The benefit of the electronic management of data is threefold:

1. The availability and access of information is increased.
2. The information can be updated globally.
3. The information can be manipulated and analyzed rapidly and efficiently.

The management materials and information through electronic means for Squadron Level Training would present all of the above benefits, the most relevant being item #2. The increased ability to update records would reduce redundancies, time spent inputting data, and increase the accuracy of the information.

One factor that needs to be considered is AFR 50-23 (Enlisted Specialty Training). From the standpoint of developing scheduling and documentation tools it is imperative that the Air Force determine what information is required. AFR 50-23 provides little guidance.

<u>ISSUE THREE: Need to improve the currency of training</u>.

Often the response to research that addresses an "old" problem such as currency of training is less than enthusiastic, people and organizations learn to live with it and accept it as a "fact of life." But what is currently a continuing nuisance rather than a crisis is likely to become a serious problem in the future. The rate of technological change is increasing. Change is occurring at a much more rapid rate today than at any time in the past. Assuming that no change occurs in the rate of change, the content of much of today's training will become obsolete faster than at any time in the past. If the methods of maintaining currency of training are not advanced at the same rate as that of other areas of technology, it will become increasingly difficult to maintain even a semblance of currency. Even though it is an old problem, we feel that it should be addressed now so as to avoid a future crisis in Air Force training.

This is a complex problem with no technically or conceptually simple solutions. Before selecting any methodology to address this problem, the entire process, from training developed in conjunction with new equipment or upgrades, to delivery of training, needs to be studied. The identification of bottlenecks, whether they be the result of the decision making process, production, or delivery, must be identified. This is an essential first step that will require studies to determine how things should be done as specified in directives and regulations, and how things are done as determined by a study of practice.

The following are possible ways of addressing the problem that should be considered once research to determine major factors of the problem is completed:

- Automated CBT training update.
- On-line updates and supplementals.
- Provide "Just In Time" training.
- Use embedded training.

Automated CBT Training Update. The cost effectiveness of this approach is dependent on the sheer quantity of CBT training available at the squadron level. Conceptually the process is very simple, updates and corrections to CBT training programs are electronically transferred and programs at the receiving end are automatically updated. This approach to updating would require that every site/base have a central computer for the storage of programs. Trainees would then be given programs retrieved from storage on the central computer, whether through a local area network, or simply copied onto a disk. Given the high level of reliability in networking and communications technology and the relatively simple task of designing standardized data files and file names, all that is required is a proof of concept study and a prototype system. The most difficult part of applying such a system is imposing a standardized system for file naming and requiring its use. Developing the prototype system could take as little as six months of development time for two researchers. Convincing Training Managers or decision makers of the worth of this effort may be more difficult.

On-line Updates and Supplementals. This approach is similar to the Automated CBT Training Update, but specialized for the reception and reproduction of printed training materials. The only important differences are the need for the creation of document structures that allow for easy upgrade, fast laser printers, and reproduction capability. The front end tasks of this project are much more difficult than the information transfer and delivery aspects. How does one get training materials upgraded and updated quickly, and with no loss in accuracy?

Just in Time Training. "Just In Time" training is a style of training that is based upon two fundamental premises. The first is that there is an improved retention of information and training for a particular type of work if and when the training is received as close as possible to the time in which it is needed. The second is that training efforts are streamlined if the training takes place only when

the skills are required. The development of a Just in Time training structure requires very accurate documentation, training and career path planning, and advanced programs to review records and determine training needs.

Embedded Training. The use of embedded training is most rewarding in situations where the task is performed infrequently or where accurate performance is critical. Embedded training simply involves the inclusion of relevant training materials in the system or set of tools required for that particular task.

For example, a computer system that is used to diagnose the cause of engine failure in any given machine may be fairly complex. The process of diagnosis would require a "funnel" of decisions beginning from a broad base of potential problems, eventually growing narrower until the cause of the engine failure is found. A system of this type may not be complex in its design, but the user must have the advantage of understanding the subject matter well enough to answer the question accurately.

In this sort of situation, a training program embedded in the tool itself would allow a user to access the required banks of information with relative ease. This avoids situations where a user is forced to deal with a computer system that they are not familiar with or do not have the necessary knowledge to take advantage of. Furthermore, it is often awkward for users to admit that they are not familiar with a given system or task. Embedded training assures that human error caused by this sort of situation will be minimized. Except for the special case of computer-based programs and tools, most embedded training is built into a system. Adding embedded training to existing equipment is usually not a feasible option.

## ISSUE FOUR: Increase the Amount of Time OJT Trainers Have to Train.

Time to train is, in a very real sense, addressed by all the previous methods discussed, and by many of the projects currently being carried out by the Armstrong Laboratory. Effective use of time is an overarching concern. Since the transfer of knowledge and the development of skills takes time, the trainers and training managers are most concerned in training new personnel in an operational setting where training, of necessity, is secondary to the job. The more quickly a trainee can become proficient in a job, the faster it translates into improved readiness, reduction of manpower requirements, and overall cost reduction.

The use of automated job aids to eliminate training clearly reduces training time. Automating training through the use of CBT or expert systems for common or simple tasks will allow the Trainer to spend time with the Trainee focusing on the more conceptually and technically difficult tasks.

ISSUE FIVE: Need Methods for Addressing Training on Tasks Seldom Performed.

When a task is seldom performed, maintaining proficiency is near impossible unless heroic training efforts are put forth. This is done very often in the Air Force. Emergency first aid, weapons training, mission training, and safety training are some of the tasks that, though seldom performed, are continuously trained and retrained. Pilots for example, are continuously trained to fight battles that, we hope, will never be fought. Yet, maintaining proficiency is an important aspect of deterrence.

For other tasks, continuous training and retraining is not a realistic option. But without training, proficiency of a skill, whether it be an administrative task seldom performed or maintenance of highly reliable equipment, will decay over time. Some current and proposed research already discussed can contribute significantly to addressing this problem. Today, portability and reliability of computer based job aids are not serious hurdles. Current AL/HRT research is addressing many of the issues involved in developing job aids for low frequency tasks, but some research is needed in the following areas:

- Standardization of job aid formats for expert systems.
- Effectiveness and efficiency of generalists training in a job aid rich environment.

The use of expert system based job aids is a feasible solution for low frequency tasks. Such job aids can be incorporated into existing systems or be developed for unique portable platforms. They should prove effective if:

- The user knows how to use the job aid, i.e., there is training provided for its use.
- The user has general job knowledge and technical skills in order to apply expert system direction.
- The job aid itself is current.

Standardized Format. Automated job aids are very useful but could be confusing to the user if every job aid has its own screen layout and command structure. The development of a standardized layout for all job aids will reduce the problems caused by idiosyncratic control functions, and screen layout.

Generalists Training. The arguments between the proponents of the technical generalists versus those of the specialists will not be solved in any research proposed here. The issue to be discussed her is whether it would be advantageous for the Air Force to train generalists in a job aid rich environment. It is generally agreed that generalists give up depth while specialists give up breadth, given equivalent training. With an increasing use of job aids it may be possible for the generalists to perform specific tasks with the same facility as specialists and also perform a broader range of tasks than any one specialist.

At this point what is needed is the development or application of a methodology for determining the skills and knowledge required of generalists as compared to specialists. AL/HR has conducted studies using methodologies that would be appropriate. A study conducted by Lamb et. al. (Dec 1987) used cluster analysis to group tasks in a study of small unit maintenance specialists for the F-16. The identification of knowledge and skills required of generalists cannot be bound by current groupings of AFSCs and job families, even though these groupings may prove to be the most appropriate. Possibly the single most difficult aspect of this research effort is having no preconceptions regarding the findings.

## Research Opportunities

The research topics previously discussed focused on addressing current training needs. But AL/HRT should not limit itself to an essentially reactive approach. Some new technologies and improvements in older technologies are opening up new areas of training research which could have a revolutionary effect on the entire training structure, including the capabilities of training at the squadron level. This section will discuss potential research areas which may produce exciting results.

### Virtual Reality

Virtual Reality (VR) is a conceptual approach to user interaction with "synthetic environments". Synthetic environments are wide-angle, three-dimensional stereo, computer generated "realities", that are visually convincing, and respond in *real-time* to the users' interactions. This technology is fast becoming an affordable alternative for military education and training.

VR as a mode of instructional delivery for training has two clear advantages:

- The ability to simulate, model and visualize both situations and data in order to enhance the students' abilities to analyze, interpret, and make decisions:
  - by providing a visually realistic depiction of complex data or information to assess relationships and patterns that would not be visible in an uncontrolled environment or with alphanumeric data.
  - by allowing a user to view a simplified version of an otherwise complex phenomenon.
- The ability to create environments for learning which not only allow students to apply and develop skills at a comparatively low cost, but also offers the possibility of accelerating the learning process itself by

turning the students' entire perceptions of reality into a fully functional interactive classroom.

Some important research currently being conducted by the Air Force in this area includes:

- 3-Dimensional Audio research exploring technology that can project sound in a three-dimensional space using a headset and the implications of human abilities to localize that information.

- Low Fidelity Helmet development efforts provide a low-cost alternative to high-cost fiber optic helmets. These developments can be applied to virtual world applications.

- Virtual Man-Machine Interaction projects are being conducted to explore virtual space simulators. Low-cost virtual worlds can be applied to training novices to fix technologically complex equipment in a virtual environment.

It is important to understand that *simulation and virtual reality are two related but separate concepts*. Simulation research is directed towards the creation of realistic synthetic environments, primarily for training. VR technology, on the other hand, is an effort to create a set of *interface tools* that allow computer users to move beyond keyboards and monitors, and step inside these computer-generated synthetic environments.

Although the public fascination with this technology is a relatively recent phenomenon, the research and development work behind VR has been silently taking place in government, university, and private sector labs for more than thirty years.

This research has yielded a semi-standard configuration for the full immersion VR system. This configuration consists of a head mounted display (HMD), an interface device (most commonly a glove or force-feedback joystick), a spatial tracking system (to translate the user's movements into the computer-generated environment), and a workstation class computer with appropriate software.

The initial development of VR both as a set of tools and as a concept took off in the late 1970s and the early 1980s, in a variety of places: The Advanced Research Projects Agency (ARPA), NASA/Ames, Atari's Sunnyvale Laboratory, and MIT's Media Lab, to name a few. More recently, the technology's relative maturity has fueled the growth of a new breed of lean yet powerful companies, like VPL Research, Inc. and Silicon Graphics, that are aggressively marketing applications of VR technology in both the public and the private sector. The stunning success of these companies has propelled computer heavyweights like Apple Computer and

IBM to look more seriously into the possibility of VR as a mass commercial technology.

The role of the military in sponsoring the beginnings of VR research was a crucial factor in the development of this technology. It was through the sponsorship of both ARPA and the Office of Naval Research that the first experiments with head mounted displays for VR were conducted by Ivan Sutherland in 1966, first at MIT's Lincoln Laboratory, and later at the University of Utah.

The sponsorship of NASA, ARPA and other military agencies created a fertile ground for many of the breakthroughs in the development of the early VR systems. This occurred not only through the availability of funding, but also through the indoctrination of researchers. Many of the companies that now dominate the small but burgeoning VR industry were started by researchers coming out of military VR and simulation labs.

If adapted, virtual reality will cause two major shifts in the teaching/learning process, neither of which has a solid base of research from which to develop actual software. First, curriculum will no longer be print based, but instead will be based on imagery (both auditory and visual). Second, learning will shift from the use of printed abstractions to the use of simulations or experiential re-creations of events in which students participate.

Much has to be learned about the characteristics of this technology for the purpose of instruction. A suggested research effort is one that will focus on the identification of critical design and development parameters related to the use of virtual reality (VR) for training. To achieve the goal, two tasks need to be accomplished:

- The analysis of current capabilities of virtual reality hardware and software.

- The identification and definition of critical parameters that influence the effectiveness of the virtual reality environment for learning, skills building and transfer of training.

## Distance Learning

Distance learning is a *need-based phenomenon* -- it arises out of the need to make information, and more importantly *education*, accessible and cost-effective. This need is more pressing in today's Air Force than ever before. While new distance learning techniques such as video conferencing, digital video and cable TV narrowcasting are being developed and applied, the more traditional methods that have been used in the past have yet to be abandoned.

In the past, the needs that stimulated the development of distance learning were primarily physical -- issues of geography, culture and mobility. These obstacles forced educators to evolve their strategy so they could continue to fulfill their teaching mission. The result was the creation and eventual acceptance of distance learning as a legitimate form of instruction. The earliest such application of distance learning can be traced to the 1880s when William Briggs established the somewhat grandly named "University Correspondence College" in England to make higher education available on a wide basis.

The same logistical problems exist in today's Air Force. The strong emphasis on cost and personnel reductions has created an even more pressing need for the re-discovery and re-development of innovative training techniques such as distance learning. This new urgency is also supplemented by the rapid growth in the volume of information and the *diversity* of skills that must be learned by Air Force personnel to allow them to manage the situations they must encounter on the job.

Today in the United States, correspondence, radio, and television are commonly used for distance learning. In addition to these "traditional" technologies, new technologies, such as Computer-Based Instruction and videotaped courseware have already had a significant impact on distance learning.

The AT&T Long Distance Learning Network (LDLN), is a good example of the impact of technology on distance learning. LDLN is a large network which supports "learning circles" in which five to eight classrooms (from several counties) are grouped together to cooperate on common projects. Teachers and students can send individual messages through a computer terminal, and post messages to a shared electronic "folder".

It would not be an overstatement to say that every advance made in communications and information transfer technologies has eventually been applied to distance learning -- and there is no reason to believe that this process of adding technologies to the distance learning repertoire will not continue. Consequently the identification of the most appropriate technologies to use for any course or set of courses is becoming much more complex. In order to provide the best quality distance learning at the least cost, it is essential to keep current with ever changing technologies. The "one hammer" approach, where, regardless of the training requirements, one technology is always used would only guarantee the production and delivery of mediocre training.

From the standpoint of this study, current research addressing questions related to distance learning should be expanded to consider other modes of information delivery with a view toward minimizing costs and maximizing effectiveness.

The increasing availability of different types of communications technology has resulted in hybrid technologies which are very powerful, and when properly applied, reduce costs.

Video teletraining, audio teletraining, audiographic teletraining, and computer conferencing are based on relatively old technology – conference calls, modem links, and television signals over satellite or landline. But used together, these systems are able to re-create – with varying degrees of fidelity – a classroom environment.

## An Issue for the Research Community

Occasionally in a research effort some findings appear which, while not directly impacting on the research goal, are of such importance that not discussing and addressing the issue would be a disservice to the sponsoring organization and the integrity of the research. The following issue is of such a nature.

- **Need to increase the applications of training technologies as they apply to squadron level training.**

Research on training in the Air Force is focusing on issues directly related to the current and future needs of the service. As such, even theoretical research can be viewed as having an applied base. Success of a research effort is largely determined by its effect on training in the Air Force. How to maximize the utilization of the products of research is an important and complex issue. Many factors influence whether research findings "sit on the shelf" or are accepted and implemented by the Air Force community. An almost certain way of assuring that research findings will not be used is having users see no need for the research, or reject the approach as too expensive or impractical. This study has shown the relatively small influence that training technology appears to have had at the operational unit level.

In both the surveys and interviews, Trainers and Trainees were asked what training methods/tools were used in their units. Table 8 reflects the percentages of respondents who indicated that they had experienced the use of the cited technologies in their units.

Table 8. Use of Training Technology

| | Trainers | | Trainees | |
|---|---|---|---|---|
| Method/Tool | Survey | Interview | Survey | Interview |
| Simulators/Mock-ups | 47.5% | 53.2% | 40.0% | 18.3% |
| Computer-based Training/Instruction | 17.5% | 36.9% | 40.0% | 24.7% |
| Interactive Video disk | 17.5% | 21.2% | 7.5% | 9.2% |

*Although Trainers have, at some time,* used the technologies as indicated above, it should be noted that their use (based on survey results) has been minimal at best. They report using only the cited technologies for 50% or more of their Trainees as follows: 25.2% simulators/mock-ups; 12.4% CBT; and 4.9% IVD.

This is considered a serious problem. Using advanced technology to provide training, regardless of its quality and effectiveness as an instructional tool, is no guarantee that the training will be used.

In order to systematically depict a strategy to address the need to increase the application of training technology to SLT, we have developed a Science and Technology Checklist which in part can assist in overcoming potential barriers early in the research effort. The checklist should not be viewed as a strategy, but rather as strategy development guidance. It is suggested that this checklist be used as part of the initial design for a research effort and that certain questions be addressed prior to proceeding with a research effort.

## Background of the S&T Checklist

The S&T Checklist can serve both as a planning tool and as a management tool. As a planning tool it can be used to identify what needs to be done. As a management tool it can be used to identify what is being done as well as what needs to be done. The checklist addresses the following topic areas:

Analysis
Cost Benefit Analysis
Resource Planning
Test and Evaluation
Documentation
Coordination/Interface
Priority Determination
Supportability
Implementation/Deployment Planning
Follow-up

Because the checklist is designed to be used for all training technology research, some topic areas and questions may not be applicable to a specific research topic.

The use of the S&T Checklist as a tool will provide the following advantages to the Air Force.

- The procedure will allow the investment strategy to be refined over time, even during the actual research activity.
- The same procedures can be applied to future studies.
- It provides a clear, easily followed "paper trail" of activities leading up to the decision making stage.
- It reduces the possibility of important factors not being considered.

- It creates a common framework for making investment decisions.
- It provides clear guidance for the development of an S&T investment strategy, including risks.

The S&T Checklist and its reference document are tools intended for long term use by the Human Resources Directorate of the Armstrong Laboratory to make decisions on what specific areas of research should be investigated.

The checklist is intended to be used by a development team. By using the checklist, information can be shared more efficiently and the current status of various activities can be documented. For example, if funding is not available, then the status of funding reflected in the checklist would be coded RED. Funding would need to be identified in order to proceed.

The S&T Checklist will give project managers and other decision makers needed documentation and history which may assist in addressing problems. The checklist will provide planners and decision makers with a tool that will assist them in determining if a particular line of research is still viable, or if changes in the approach are needed.

The S&T Checklist does not replace the various reports and documents needed or required, it supplements them.

Besides its use as a planning tool, the checklist can also serve as a management tool. Through a process of periodic reviews and updating, a line of research can be kept on track and problems addressed as they are noted. The S&T Checklist Guide and Checklist can be found at Appendices H and I respectively.

<u>Science & Technology Investment Strategy Checklist Reference Document</u>

To assist future users of the S&T Checklist, a reference document was prepared which will give future users a general understanding of the topics to be addressed in the checklist and possible strategies to address each topic. The reference document provides general guidance to assist users to identify or develop the best procedure or strategy to address a specific checklist item. The reference document can be found at Appendix J.

Overall current research efforts address various aspects of the squadron training needs identified. Though additional research efforts and enhancements of current research are proposed in this report, it appears that what is needed to maximize the benefits (and impact) of current and future research efforts to the Air Force is a strategic plan that will provide a systematic strategy to achieve overall training goals.

| Instructional System Development | Processes | Adv. Instructional Design Advisor (AIDA) | Base Training System (BTS) | Basic Job Skills | CBT Selection | CODAP | Job Aiding/Training Allocation Tech | Job Performance Measurement (JPM) | Instructional Support System | Integrated Maint Info System (IMIS) | Part Task Trainers (PTTs) | Intellegent Tutoring Systems | Logistics Command and Control | Training Impact Decision System (TIDES) | Transform | Multi-Task Trainer Research (MTTR) |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| ANALYZE SYSTEM REQUIREMENTS | Training Needs Assessment | | | | | | | | | | | | | | | |
| | *analyze situation* | | | | | | • | | | | | | | | | |
| | *identify parameters* | | | | • | | • | | | | | | • | | | |
| | Define/Analyze Job Performance Rqts | | | | | | | | | | | | | | • | |
| | *develop task listing* | | • | | | • | | | | | | | | • | • | |
| | *analyze job tasks* | | • | • | | | | | | | | | • | | • | |
| | *est. target pop characteristics* | | | | | | | | | | | | | | | |
| *DEFINE EDUCATION & TRAINING RQTS* | Select Tasks Requiring Training | | • | | | • | • | | | • | | | | | | |
| | Determine Student Prerequisites | | | | | | | | | | | | | | | |
| | Select Appropriate Training Setting | | | | | | • | | | | | | | • | | |
| | Forcast Resource/Logistics Rqts. | | • | | • | | | | | | | | | • | | |
| *DEVELOP OBJECTIVES & TESTS* | Develop Objectives | • | • | • | | | | | | | | | | | • | |
| | Develop Tests | • | • | | | • | | | | | | | | | • | |
| | Develop Job Performance Testing Methods | | | | | | | • | • | | | | | | | |

• *Denotes that a project adds to the technology or knowledge base of a process*

Table 9. Areas of ISD Framework Addressed

| Instructional System Development | Processes | Adv. Instructional Design Advisor (AIDA) | Base Training System (BTS) | Basic Job Skills | CBT Selection | CODAP | Job Aiding/Training Allocation Tech | Job Performance Measurement (JPM) | Instructional Support System | Integrated Maint Info System (IMIS) | Part Task Trainers (PTTs) | Intellegent Tutoring Systems | Logistics Command and Control | Training Impact Decision System (TIDES) | Transform | Multi-Task Trainer Research (MTTR) |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| *PLAN, DEVELOP & VALIDATE INSTRUCTION* | Plan Sequence of Instruction | • | | | | | | | | | | | | | | |
| | Select Instructional Method | | | | | | • | | | | | | | | | |
| | *evaluate alternative instructor methods* | • | | | • | | | | | | | | | | | |
| | *select instructional method* | • | | | | | • | | | | | | | | | |
| | *establish detailed course design* | • | | | | | | | | | | | • | | | |
| | Select Instructional Media | | | | | | | | | | | | | | | |
| | *evaluate candidate media* | | | | • | | | | | | | | | | | |
| | *select instructional media* | | | | • | | | | | | | | | | | |
| | *develop system specifications* | | | | • | | | | | | | | • | | | |
| | Determine Resource and Funding Rqts. | | • | | • | | | | | | | | | • | | |
| | Develop Instructional Materials | | | | | | | | | | | | | | | • |
| | *author instructional material* | • | • | • | | | | | • | • | • | | • | | | • |
| | *produce instructional material* | • | • | • | | • | | | • | | • | | • | | | • |
| | Validate Instructional Materials | | | | | | | | | | | | | | | |
| | *review courseware prototype* | • | | | | | | | | | | | • | | | |
| | *individual & small group tryouts* | • | | | | | | | • | | | | • | | | |
| | Validate Complete System | | | | | | | • | | | | | | | | |

• *Denotes that a project adds to the technology or knowledge base of a process*

Table 9. Areas of ISD Framework Addressed (Cont.)

| Instructional System Development | Processes | Adv. Instructional Design Advisor (AIDA) | Base Training System (BTS) | Basic Job Skills | CBT Selection | CODAP | Job Aiding/Training Allocation Tech | Job Performance Measurement (JPM) | Instructional Support System | Integrated Maint Info System (IMIS) | Part Task Trainers (PTTs) | Intellegent Tutoring Systems | Logistics Command and Control | Training Impact Decision System (TIDES) | Transform | Multi-Task Trainer Research (MTTR) |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| CONDUCT & EVALUATE | Deliver Instruction | • | • | • | | | | | • | • | • | • | • | | | |
| | Support Instruction | | | | | | | | | | | | | | | |
| | *schedule students* | | • | | | | | | • | | | | | | | |
| | *schedule resources* | | • | | | | | | • | | | | | | | |
| | *track student progress* | | • | • | | | | | • | • | | | | | | |
| | *manage ind training rqts* | | • | | | | | | | • | | | | | | |
| | *maintain & update instructor system* | | • | | | • | | | | | | | | | | |
| | Evaluate Instruction | | | | | | | | | | | | | | | |
| | *evaluate internal validity* | | • | | | | | | | | | | | | | |
| | *evaluate external validity* | | • | | | | | • | | | | | | | | |
| | *measure utility & cost-benefit* | | | | | | | | | | | | | | | |

• *Denotes that a project adds to the technology or knowledge base of a process*

Table 9. Areas of ISD Framework Addressed (Cont.)

# THE RESEARCH AGENDA

## Organization of the Section

A number of individual research efforts have been suggested in this document. This section provides an overall research agenda which we feel will address the most significant problems and needs of training at the squadron level. This agenda is divided into three parts: 1) Research efforts that can be done in a relatively short time frame and be rapidly implemented. The short term research efforts are all low risk efforts based on well understood technology. 2) Studies designed to gather and present information which could lead to applied research efforts and policy changes. 3) Long-term or high risk research efforts are those that will require a significant amount of time to develop and where the underlying theory and/or applications hardware and software is in flux. Long-term efforts focus primarily on potential future problems, needs, or opportunities that could significantly enhance the quality or change the nature of future training . Long-term efforts are typically medium or high risk in that they can be impacted by numerous factors, such as continuation of funding, maintaining long term support for the effort, improvements in competing technologies, changes in priorities, and maintaining the needed management and research staff.

Within each category, the ordering of the research activities is based on the following:

1. The importance of a project as it relates to current SLT needs.

2. The potential for rapid development and implementation.

3. The likelihood of the research to be carried through successfully.

For each research topic the following information is given:

**Impact** – What effect this research is likely to have on squadron level training.

**Risk** – (High/Medium/Low) – The likelihood of the research to be carried out successfully, and if carried out to be implemented.

## Short-Term Research Efforts

### CBT for the trainer (OJT-Trainer CBT)

Impact: Increased quality of training.
Risk: Low

The implementation of this program should increase the quality of OJT by improving the training knowledge and skills of the OJT trainer. The risk is low since CBT as a delivery technology is well understood and the content for such a program can be largely based on existing materials developed for instructor led training.

Assuming that only limited front end research needs to be conducted, an OJT-Trainer CBT can be developed in less than a year using 2.5 professional person years. The distribution and implementation of an OJT-Trainer CBT would have Air Force wide impact, effecting all OJT training at a very low cost in time, money, and personnel.

### CBT training on documentation and scheduling for automated systems

Impact: Free up training time for Training Managers and Trainees.
Standardization of instruction.
Risk: Low

The use of a CBT training program on documentation and scheduling may help reduce the time spent by training managers on this task. Such a program would help reduce errors that can occur in this process. The risk is very low.

### User friendly interface and on-line help for automated scheduling and documentation

Impact: Improve quality of scheduling and documentation by reducing errors and reduce time spent on these tasks.
Risk: Medium (some problems may arise due to integration into existing systems).

Developing the most user friendly interface possible and useful on-line help can improve the quality of scheduling and documentation by reducing time required for inputting data and reducing errors. The process for developing a user friendly interface and a useful help menu can be divided into two general steps: 1) gather user input on how they work with the system and what types of help information is needed, and 2) develop and incorporate user requirements into the interface and on-line help. The most difficult problem faced by the researchers would be the integration of the interface into a system.

OJT-Expert: Expert System based training guidance

Impact: Improve the quality of training delivery.
Risk: Low

The use of an Expert System to provide advice and assistance to OJT trainers can help enhance the quality of training by providing expert advice on training delivery questions. This effort must first focus on identifying training delivery problems faced by trainers. To gather this information both interviews of trainers and trainees, and observations of the training process across a variety of squadron level training environments are required. Training experts would then analyze the problems identified and propose approaches to address the problem. Once these steps are accomplished an expert system consultation program would then be developed to help trainers identify solutions to specific training problems.

## Studies

Standardization of formats for expert system based job aids

Impact: Reduce confusion and reduce need to learn new formats.
Risk: Low

The Air Force, in the near future, will likely be using a greater number of "intelligent" job aids. The use of a standard interface format will reduce the time required to learn to use various job aids, and reduce frustration that can result from different jobs aids having different command structures. The end product of this research effort would be a report describing the format initial layout, command structure and standard feedback structure to be included in all job aids.

Analysis of current and projected future capabilities of virtual reality hardware and software

Impact: Enhance future training
Risk: Low

The likely increased use of virtual reality (VR) programs for training will require the Air Force to select appropriate hardware and software. With the increasing number of tools being developed for use in the development and delivery of VR programs, a study of the characteristics of VR hardware and software is essential. The document produced can be used by developers to select appropriate tools for the task at hand. The report would be based on information collected from VR technology vendors through interviews and in-depth analysis of reports and studies.

**The identification and definition of critical parameters that influence the effectiveness of the virtual reality environment for learning, skills building and transfer of training**

Impact: Lead to the development of a structure similar to ISD to guide VR applications development.
Risk: Low

The purpose of this study is to develop guidance for VR training applications developers similar to ISD documentation. In order to accomplish this it is important to identify critical parameters of the VR environment effecting learning, skills building and transfer of training. Most on the needed information is available but disbursed throughout the VR research and development community. This research effort will gather the information through archival studies and interviews and site visits with developers at selected research laboratories and development houses involved in VR. Once the data is gathered, it will be structured as guidance for the development of VR training applications.

**The use of automated job aids to eliminate training**

Impact: Expand capacity of the technician, and free up training time.
Risk: Low

The study would focus on the impact of the use of automated job aids for use in place of training. This study would focus on the impact of automated job aids to replace task-specific training. The replacement of training with automated job aids can lead to a reduction of training and an expansion of the capacity of technicians to perform a wider variety of tasks. On the basis of this study the Air Force may be able to increase the use of automated job aids and reduce task-specific training.

**High level data integration of data sources**

Impact: Can provide necessary training data regardless of the type of system used for initial storage.
Risk: High

The integration of sources of training data such that data can be shared by all system users would be an ideal situation. The implementation of the entire Advanced Training System package could well address this need. Because of the high cost involved a detailed implementation study should be conducted to determine a strategy of implementation.

Effectiveness and efficiency of generalists training in a job-aid rich environment

Impact: Could lead to the restructuring of Air Force job structure and training.
Risk: Low (such a study would provide useful information, but could possibly have no effect on training.)

Because of the down-sizing of the Air Force and increasing budget constraints, the need may arise for the complete restructuring of Air Force training. The Air Force may continue to find itself in the position of doing more with less manpower.

This major study would consider the feasibility of providing generalists training in place of specialist training in a job aid rich environment. The impact of the acceptance and implementation of the findings of this study (if the findings prove that generalists can perform as well as specialists in a job aid rich environment) would be significant. This could result in the complete rethinking of the Air Force training concept.

## Long-Term/High Risk Research Efforts

Use of distance learning

Impact: Squadrons will be able to access training not locally available This will affect those jobs where relatively few specialists are at any one location.
Risk: Medium

The use of distance learning can have a significant impact at the squadron level by providing access to training not locally available. Distance learning would likely impact most heavily those jobs where relatively few specialists are at any one location. The concept of distance learning is well developed. The effort would be the creation of fully flexible prototype networks that could provide the level of interactivity needed for a specific training to effectively carry out training. Cost and maintenance of such a system would be major considerations. As a first step a feasibility study should be conducted.

Enhanced expert/professional support (Better Training Managers)

Impact: Provide on-site experts.
Risk: High (Cost factors involved in training and retraining may prove prohibitive).

This effort would consider the feasibility of restructuring of the 75XXX career field such that 75XXXs would act as general training SMEs at the base and squadron levels. The availability of training SMEs at every base would increase the capacity of units to locally develop high quality training materials and programs and provide training advice and assistance to OJT trainers. The effort would include

identification of knowledge and skill requirements, the development of a program of training for 75XXXs, the training of a select group, and the study of their performance and impact at bases of assignment. This effort is a high risk effort requiring strong commitment of operational commands. The cost of such an effort would be significant and may prove to be prohibitive.

Automated CBT training update

Impact: Provide current and consistent training worldwide.
Risk: High (The effectiveness of such a program is dependent on high levels of integration of information and the existence of significant numbers of CBT training programs).

An automated CBT training update system where CBT programs are updated automatically would assure current and consistent training worldwide. The risk in the development of such a system is high since the cost effectiveness would be dependent on the number of CBT training programs in use. Such a system would require a significant degree of standardization in the structure of CBT programs including the standardization of the development language and file structure. This approach should be considered when CBT training has become a large portion of Air Force training.

The system would function only if there is a centralized control of CBT programs. All commands would need to work through a central office/location for the management of computer-based training, most likely under the control of ATC. A high level of commitment and support would be essential for such a system to function effectively. No research currently exists on how such a concept would function. The development team would require a number of different skills for the development of such a system such as data management, wide area networks, CBT design, and CBT programming.

On-line updates and supplementals

Impact: Improve the currency of training.
Risk: High (Effort will require massive networking, standardization, and the availability of relatively powerful microcomputers).

As with Automated CBT training updates, this effort would be a major effort. Centralized control would be essential along with maintaining a high level of standardization.

**Provide "Just In Time" training**

Impact: Significantly improve the quality of lifetime training in the Air Force.
Risk: High

This project is basic research in the Air Force environment to develop a methodology for determining the skills and knowledge required by generalists. Such research would address boundaries between AFSCs, required depth and breadth, transfer of training issues, and the selection of formalized ways of identifying the structure of knowledge and the structure of the disciplines within a grouping of specialties. Such a research effort cannot be bound by current groupings of AFSCs and job families, even though these groupings may prove to be the most appropriate. As such, the methodology for developing a methodology to determine skills and knowledge required by a generalists in a job aid rich environment must be fairly rigid so that the findings would not be biased by the researcher's preconceived notions of what the findings will support.

Significant problems need to be researched for which no basic work of significance exists: how to identify an individuals training needs on a continuous basis, what type of administrative structure is required, and how to assure that the material is current, are just some of the issues that would need to be addressed.

For such an effort a feasibility study would be essential. The amount of time and the type of personnel required for the development and implementation of a Just In Time training would be identified in such a feasibility study.

## Conclusion

Today's Air Force is the best in the world. The quality of today's airman is in many respects the best in the history of the U.S. Air Force. The enlisted force today is the most highly educated cadre of enlisted personnel that has ever been in uniform. This is an enviable position. These airmen come with all the needed basic skills required to take advantage of the training provided. Yet this should not lead to complacency. The down-sizing of the Air Force, the changing world situation, demographic changes in the U.S., increasingly complex and rapidly evolving technology, and reduction in the available budget mean that today's airman must do more, and know more. If the Air Force is to continue to maintain its technological edge, it is essential that today's and tomorrow's airmen be the most professional and technically competent of any cadre in the history of the Air Force.

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# Appendix A

# Instructional System Development Process and Survey Item Match

## INSTRUCTIONAL SYSTEM DEVELOPMENT PROCESS AND SURVEY ITEM MATCH

Interpreting the Data:

Each section, process, and subcategory of the ISD process is identified by a specific code. The following is the index to the meanings of the code numbers.

**1. ANALYZE SYSTEM REQUIREMENTS**

1.1 Training Needs Assessment
1.1a analyze problem
1.1b identify parameters
1.2 Define/Analyze Job Performance Requirements
1.2a develop task listing
1.2b analyze job tasks
1.2c establish target population characteristics

**2 DEFINE EDUCATION & TRAINING REQUIREMENTS**

2.1 Select Tasks Requiring Training
2.2 Determine Student Prerequisites
2.3 Select Appropriate Training Setting
2.4 Forecast Resource/Logistic Requirements

**3 DEVELOP OBJECTIVES & TESTS**

3.1 Develop Objectives
3.1a develop criterion and objectives
3.1b develop job performance testing standards
3.2 Develop Tests

**4 PLAN, DEVELOP & VALIDATE INSTRUCTION**

4.1 Plan Sequence of Instruction
4.2 Select Instructional Method
4.2a evaluate alternative instructional strategies
4.2b evaluate alternative management strategies
4.2c establish course design strategy
4.3 Select Instructional Media
4.3a evaluate candidate media
4.3b select instructional media
4.3c develop system specifications
4.4 Determine Resource and Funding Requirements
4.5 Develop Instructional Materials
4.5a author instructional material
4.5b produce instructional material
4.6 Validate Instructional Materials
4.6a review courseware prototype
4.6b individual & small group tryouts
4.7 Validate Complete System

**5 CONDUCT & EVALUATE**

5.1 Deliver Instruction
5.2 Support Instruction
5.2a schedule students
5.2b schedule resources
5.2c track student progress
5.2d manage training requirements
5.2e maintain & update instructional system
5.3 Evaluate Instruction
5.3a evaluate student performance
5.3b evaluate job performance
5.3c measure utility & cost-benefit

Survey items are coded as follows:

First Digit........ 2- Training Manager Survey Form
3- Trainers Survey Form
4- Trainees Survey Form
Second Digit....... Survey Item Number
Lower Case Letter...Specific Response

Each question, or when possible response, is identified to specific ISD categories. Items may be members of multiple categories. Survey items which are purely demographic are not included in this listing.

| | |
|---|---|
| 1 | |
| 1.1 | 2-22, 2-23, 2-24, 2-35, 2-36, 2-37, 2-38, 2-49, 2-52, 2-53, 2-57a, 2-60, 3-23, 3-24, 3-25, 3-58, 3-61 |
| 1.1a | |
| 1.1b | |
| 1.2 | 2-22, 2-23, 2-24, 2-35, 2-36, 2-37, 2-38, 2-52, 2-53, 2-57b, 3-23, 3-24, 3-25, 3-61 |
| 1.2a | |
| 1.2b | |
| 1.2c | 2-6j, 3-8, 3-9, 3-10 |
| 2 | |
| 2.1 | 2-22, 2-23, 2-24, 2-33, 2-49, 2-57c, 3-23, 3-24, 3-25, 3-58 |
| 2.2 | 2-22, 2-23, 2-57d, 2-63f, 2-64f, 2-65f, 2-66f, 3-23, 3-24, 3-25, 3-69f, 3-70f, 3-71f, 3-72f |
| 2.3 | 2-8b, 2-33, 2-57e |
| 2.4 | 2-8b, 2-11, 2-33, 2-57f, 2-59, 2-60, 2-65, 2-66, 2-68, 2-69, 3-13, 3-71, 3-72, 3-74, 3-75 |
| 3 | 2-20, 3-21 |
| 3.1 | 2-22, 2-23, 2-24, 3-23, 3-24, 3-25 |
| 3.1a | 2-58a, 2-59a, 2-60a, 3-64a, 3-65a, 3-66a |
| 3.1b | 2-59c, 2-60c, 3-64c, 3-65c, 3-66c |
| 3.2 | 2-58b, 2-59b, 2-60b, 3-64b, 3-65b, 3-66b |
| 4 | 2-20, 2-21, 3-21, 3-22 |
| 4.1 | 2-58c, 2-59d, 2-60d, 3-64d, 3-65d, 3-66d, 4-41 |
| 4.2 | 2-58e, 2-59e, 2-60e, 3-64e, 3-65e, 3-66e, 4-39, 4-40, 4-41, 4-42, 4-43, 4-44, 4-45, 4-46, 4-47 |
| 4.2a | 2-14c |
| 4.2b | |
| 4.2c | |
| 4.3 | 2-55, 2-56, 2-58f, 2-59f, 2-60f, 2-61, 2-62, 3-11, 3-63, 3-64f, 3-65f, 3-66f, 3-67, 3-68, 3-87, 4-39, 4-40, 4-41, 4-42, 4-43, 4-44, 4-45, 4-46, 4-47 |
| 4.3a | |
| 4.3b | |
| 4.3c | 2-14a, 2-31 |
| 4.4 | 2-6i, 2-31, 2-35, 2-36, 2-37, 2-38, 2-51, 2-55, 2-56, 2-65, 2-66, 3-12, 3-60, 3-63, 3-71, 3-72 |
| 4.5 | 2-6b, 2-22, 2-23, 2-24, 2.54, 2-55, 2-56, 2-58g, 2-59g, 2-60g, 3-11, 3-23, 24, 3-25, 3-62, 3-63, 3-64g, 3-65g, 3-66g, 4-39, 4-40, 4-41, 4-42, 4-43, 4-44, 4-45, 4-46, 4-47 |
| 4.5a | |
| 4.5b | |
| 4.5c | |
| 4.6 | 2-22, 2-23, 2-24, 2-54, 2-58h, 2-59h, 2-60h, 3-23, 3-24, 3-25, 3-62, 3-64h, 3-65h, 3-66h |
| 4.6a | |
| 4.6b | |
| 4.7 | 2-6h, 2-22, 2-23, 2-24, 2-51, 3-23, 3-24, 3-25, 3-60, 3-64i, 3-65i, 3-66i, 4-7, 4-8, 4-9,4-10, 4-11, 4-12, 4-13, 4-14, 4-15, 4-16 |

5

**5.1** 2-6c, 2-8c, 2-7, 2-49, 2-50, 2-52, 2-53, 2-54, 2-61, 2-62, 2-72, 2-74, 2-75, 2-76, 2-79, 3-26, 3-27, 3-28, 3-29, 3-30, 3-31, 3-32, 3-33, 3-34, 3-35, 3-36, 3-37, 3-38, 3-39, 3-40, 3-41, 3-42, 3-43, 3-44, 3-45, 3-46, 3-47, 3-48, 3-49, 3-50, 3-51, 3-52, 3-53, 3-58, 3-59, 3-61, 3-62, 3-67, 3-68, 3-80, 3-81, 3-88, 4-6, 4-17, 4-18, 4-19, 4-20, 4-21, 4-22, 4-23, 4-24, 4-25, 4-28, 4-32

**5.2** 2-6d, 2-8a, 2-6f, 2-7, 2-25,2-26, 2-27, 2-28, 2-29, 2-30, 2-31, 2-32,2-33, 2-35, 2-36, 2-37, 2-38, 2-48, 2-60, 2-69, 2-77, 2-78, 3-55, 3-57, 3-82, 3-83, 3-84, 3-85, 3-86, 4-28, 4-51

**5.2a** 2-6a, 2-8d, 2-8e, 2-9, 2-10, 2-11, 2-12, 2-13a, 2-16, 2-17, 2-19, 2-34, 2-39, 2-63a, 2-64a, 2-65a, 2-66a, 3-16, 3-69a, 3-70a, 3-71a, 3-72a, 4-31, 4-33, 4-38

**5.2b** 2-9, 2-10, 2-11, 2-12, 2-13b, 2-16, 2-17, 2-19, 2-63b, 2-64b, 2-65b, 2-66b, 2-68, 3-15, 3-69b, 3-709b, 3-71b, 3-72b, 3-74, 3-75, 4-35

**5.2c** 2-6e, 2-8f, 2-9, 2-10, 2-11, 2-12, 2-13c, 2-15, 2-16, 2-17, 2-18, 2-19, 2-34, 2-39, 2-63c, 2-64c, 2-65c, 2-66c, 3-69c, 3-70c, 3-71c, 3-72c

**5.2d** 2-14d, 2-16, 2-17, 2-18, 2-19, 2-63d, 2-64d, 2-65d, 2-66d, 3-18, 3-44, 3-45, 3-46, 3-47, 3-48, 3-49, 3-50, 3-51, 3-69d, 3-70d, 3-71d, 3-72d, 4-29, 4-32, 4-34, 4-36, 4-37, 4-38

**5.2e** 2-16, 2-19, 2-63e, 2-64e, 2 65e, 2-66e, 3-14, 3-17, 3-20, 3-44, 3-45, 3-45, 3-46, 3-47 3-48, 3-49, 3-50, 3-51, 3-69e, 3-70e, 3-71e, 3-72e

**5.3** 2-30, 2-31, 2-32, 2-33, 2-35, 2-36, 2-37, 2-38, 2-40, 2-41, 2-42, 2-43, 2-44, 2-45, 2-46, 2-47, 2-65, 2-6, 2-80, 3-19, 3-54, 3-56, 3-71, 3-72, 4-52

**5.3a** 2-6g, 2-67a, 2-67b, 2-68a, 2-68b, 2-69a, 2-69b, 3-10, 3-73a, 3-74a, 3-75a, 3-73b, 3-74b, 3-75b, 4-30

**5.3b** 2-67c, 2-67d, 2-68c, 2-68d, 2-69c, 2-69d, 3-73c, 3-74c, 3-75c, 3-73d, 3-74d, 3-75d

**5.3c** 2-67e, 2-68e, 2-69e, 3-73e, 3-74e, 3-75e

# Appendix B

# Annotated Survey Forms, Phase II

*(This Appendix contains the individual surveys administered to Training Managers (B-1), Trainers (B-2), and Trainees (3-3), annotated with response frequency percentages. The numbers immediately following each response are those percentages of respondents who selected the particular response. If there are two numbers following a response, such as "25.2 (30.8)," the first number represents the percentage of all respondents, and the second number in parenthesis represents the percentage of just those respondents who responded to that particular question. This annotation will be found on those questions for which more than one response was allowed.)*

# Appendix B-1

# Training Manager Survey Form

# Squadron Level Training

# Survey Form

# For Training Managers

| | |
|---|---|
| ***Prepared For:*** | Technical Training Research Division<br>Human Resources Directorate of the<br>Armstrong Laboratory<br>Brooks A.F.B., TX 78235-5601 |
| ***Prepared By:*** | HAY Systems, Inc.<br>Suite 650<br>2000 M Street, N.W.<br>Washington, DC 20036 |

1 November 1991

***Version Number:***
***0002***

To All Survey Participants:

You have been selected to take part in a survey covering various aspects of training in the Air Force. This project is being sponsored by the Technical Training Research Division, Human Resources Directorate of the Armstrong Laboratory, Brooks AFB, TX.

The information will be used for research on training at Operational Units in the Air Force. Rapidly changing technology in a changing world requires that Air Force training be responsive. Your assistance with this survey will help us better understand the viewpoint of those involved in base level training and the on-site training process.

The information you provide will be kept in strictest confidence. The background information that you are asked to provide on the answer sheet will be used to help assure that, overall, the people completing this survey are representative of the total population in the Air Force.

---

Privacy Act Statement

Authority: 5 USC Sec 301, EO9397, and AFR 35-2

Principal Purpose: Collection of information concerning training program development and evaluation. SSAN for positive identifications.

Routine Area: Personnel research and personnel management system applications.

Disclosure: Failure to complete this requirement will detract from the Air Force's capability to carry out programs listed above.

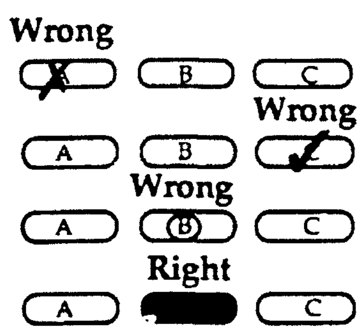
# *Squadron Level Training Survey Form*

## Instructions For Completing The Questionnaire


- You should have two sharpened pencils and an eraser.
- Mark all answers on the answer sheet only.

### Do Not Mark On The Survey Forms

- Make heavy black marks that fill the oval completely. (See examples at right, which show both correctly and incorrectly marked answer spaces.)
- Fill in just one oval unless you are given instructions to mark all that apply.
- If you wish to change an answer, erase completely.
- Make no stray marks on the answer sheet.




### *Filling In The Answer Sheet*

**Do Not Fill In Your Name or Date of Birth**

Before answering any of the survey questions, fill in the following information in the spaces as indicated.

Name Grid:

- Using LIST A on the following page, enter the letter that matches the major command, field operating agency, or direct reporting unit in the first column of the Last Name section of your answer sheet.
- Using LIST B on the following page, enter the letter that matches the type of unit to which you are assigned in the first column of the First Name section of your answer sheet.

**Social Security Number Grid:**

- Fill in your Social Security Number.

"Grid" Grid:

- Fill in the Version Number located in the lower right corner of the Survey form cover sheet; use all four columns, for example, 0004.

Be sure to fill in the information as shown in the Grid-Marking Example shown on the lower right hand corner of side one of your answer sheet.
Starting in row 1 of your answer sheet fill in your responses. This survey should take you less than one hour to complete.
After completion of this survey, return the survey form and the answer sheet to the person who gave you these materials.

## LIST A

## AIR FORCE MAJOR COMMANDS, FIELD OPERATING AGENCIES, AND DIRECT REPORTING UNITS

Enter the LETTER that matches your selection on the first Column of the Last Name section of your answer sheet.

A. Air Force Logistics Command (AFLC) *2.5*
B. Air Force Systems Command (AFSC) *3.5*
C. Air Force Space Command (AFSPACECOM) *0.3*
D. Air Training Command (ATC) *3.8*
E. Air University (AU) *4.8*
F. Electronic Security Command (ESC) *0.8*
G. Military Airlift Command (MAC) *16.8*
H. Strategic Air Command (SAC) *22.6*
I. Tactical Air Command (TAC) *15.6*
J. Air Force Combat Operations Staff (AFCOS) *0.3*
K. Air Force Communications Agency (AFCA) *0.5*
L. Defense Agency *0.0*
M. Air Force District of Washington (AFDW) *0.0*
N. Air Force Inspection Center (AFIC) *0.3*
O. Air Force Intelligence Agency (AFIA) *0.0*
P. Air Force Legal Services Center (AFLSC) *0.0*
Q. Air Force Management Engineering Agency (AFMEA) *0.0*
R. Air Force Military Personnel Center (AFMPC) *0.3*
S. Air Force Morale, Welfare, and Recreation Agency (AFMWRA) 0.3
T. Air Force Office of Medical Support (AFOMS) *0.0*
U. Air Force Office of Security Police (AFOSP) *0.3*
V. Air Force Office of Special Investigations (AFOSI) *0.0*
W. Air Force Operational Test and Evaluation Center (AFOTEC) *0.0*
X. Air Force Safety Center *0.0*
Y. US Air Force Academy (USAFA) 0.0
Z. Other *27.6*

(USAFE 17.8)
(PACAF 2.8)

## LIST B

## DESCRIPTION OF UNIT OF ASSIGNMENT

Enter the LETTER that matches your selection on the first Column of the First Name section of your answer sheet.

A. Aircraft Maint *17.0*
B. Audiovisual *0.5*
C. Audit 0.0
D. Chaplain *0.3*
E. Civil Engnrg *5.3*
F. Communications *6.6*
G. Comptroller *2.3*
H. Education *2.8*
I. Flying Sqn *4.1*
J. Info Mgmt *1.5*
K. Legal *0.0*
L. Manpower *0.0*
M. Medical *3.3*
N. Missile Sqn *1.5*
O. MWR *0.0*
P. Personnel *3.3*
Q. Public Affairs *0.0*
R. Safety *0.0*
S. Security Police *4.3*
T. Services *2.5*
U. Social Actions *0.3*
V. Supply *4.1*
W. Transportation *3.8*
X. Training *19.3*
Y. Weather *0.5*
Z. Other *16.8*

## Section I - Demographics

**Please do not proceed until you have completed the section entitled "Filling In The Answer Sheet".**

1. **Your grade:**

   a. E-3 Airman First Class *0.0*
   b. E-4 Senior Airman/Sergeant *13.8*
   c. E-5 Staff Sergeant *37.3*
   d. E-6 Technical Sergeant *26.8*
   e. E-7 Master Sergeant 18.5
   f. E-8 Senior Master Sergeant 1.8
   g. E-9 Chief Master Sergeant 0.5
   h. G-S Civilian 1.5
   i. W-G Civilian 0.0

2. **Years on active duty (Military); years with Civil Service (Civilians):**

   a. 1 to 4 years 1.0
   b. 4 to 8 years 15.3
   c. 8 to 12 years 28.9
   d. 12 to 16 years 29.1
   e. Over 16 years 25.6

3. **Your current role in the training process is: (Mark all that apply)**

   a. Squadron training monitor 23.5
   b. Section training monitor/coordinator 12.3
   c. Squadron OJT monitor 22.8
   d. Section OJT monitor/coordinator 9.3
   e. Instructor (Classroom, does not include OJT Trainer) 15.0
   f. Unit Training Manager 75.0
   g. Base Training Manager 8.5
   h. Ancillary Training Manager 30.5
   i. Civilian Training Manager 6.3
   j. Formal Training Monitor 22.8
   k. I have no training role at this time 2.8

4. **Years in Training Role:**

   a. Less than 1 year 12.3
   b. 1 to 4 years 35.3
   c. 4 to 8 years 24.3
   d. 8 to 12 years 17.0
   e. over 12 years 11.0

**5. Is your role in the training process your primary job or an additional duty?**

a. Primary job 71.9
b. Additional duty 28.1

## Section II - Your Functions In Managing Training

This survey asks about several types of activities in managing and delivering training at the unit level. Please indicate which functions are a part of your responsibilities. Separate sections of the questionnaire apply to each function.

**6. Which of the following tasks do you do? (Mark all that apply)**

a. Schedule students into training. 78.3
b. Develop training courses or exercises. 34.5
c. Conduct formal or informal training. 60.0
d. Assist supervisors with OJT training. 84.0
e. Document training completed by individuals. 63.8
f. Report training activity. 64.0
g. Evaluate individual performance. 41.5
h. Evaluate training system performance. 55.0
i. Conduct long range planning for training. 56.0
j. Assess the need for new training programs. 63.3

**7. Approximately what portion of your duty time is normally spent on training, including both conducting training and/or management? (Mark one response only)**

a. All or nearly all 48.4
b. About three-quarters 16.5
c. About half 11.3
d. About one-quarter 9.8
e. About five to ten percent 7.0
f. Less than five percent 7.0

## Section III - Scheduling

Questions 8-12 apply to individuals who are involved in scheduling students for training, either within or outside the duty section. If you do not routinely schedule people for training, please skip to Section IV.

348 Respondents of 400 = 87% (First percent listed is of the total 400. Percent in parenthesis is of the 348 who actually responded)

**8. Which scheduling functions do you normally do? (Mark all that apply)**

a. Schedule personnel for training. 76.3 (87.6)
b. Schedule class times and locations. 53.8 (61.8)
c. Schedule the use of equipment (e.g., aircraft, simulators, computers, etc.) for instructional use. 31.8 (36.5)
d. Notify students of scheduled ancillary training. 57.3 (65.8)
e. Notify students of scheduled Enlisted Specialty Training (EST). 63.0 (72.4)
f. Send reminder notices to students. 47.3 (54.3)
g. Plan make-up sessions for students who miss a training session. 42.3 (48.6)
h. None of the above. 5.0 (5.7)

**9. About what portion of your duty time is normally spent on scheduling?**

a. All or nearly all 3.4
b. About three-quarters 5.5
c. About half 16.1
d. About one-quarter 27.3
e. About 5 to 10 percent 23.0
f. Less than 5 percent 24.7

**10. How would you describe the systems you currently use to do your scheduling? (Select one)**

a. Fully automated. 7.8
b. Automated scheduling from manual input. 39.2
c. Manual scheduling from automated input (source documents). 27.1
d. Fully manual. 25.9

**11. What are the manual sources of information you use in scheduling?** (Mark all that apply)

a. AF Form 2426 49.8 (57.2)
b. AF Form 1320/1320a (Training Chart) 4.3 (4.9)
c. AF Form 403 (Request for Special Technical Training) 16.3 (18.7)
d. Letters/memos of request 64.0 (73.6)
e. Workcenter rosters 31.0 (35.6)
f. Printouts received from some other source 46.3 (53.2)
g. DD Form 1556 13.5 (15.5)
h. Other 21.5 (24.7)
i. None 1.8 (2.0)

**12. How adequate are the sources of information that you currently use for scheduling?** (Mark one response only)

a. Completely adequate 45.0
b. Somewhat adequate 48.7
c. Somewhat inadequate 5.4
d. Completely inadequate 0.9

**Please use the following scale to rate each of the aspects of scheduling in items 13 to 19.**

a. Not a problem at present - no improvement needed.
b. Only minor problems with this at present.
c. Some problems with this - improvement desirable.
d. Major problems with this - improvement urgently needed.
e. Not relevant to scheduling.

**13. Access to existing data systems needed for scheduling.**

a. 39.3
b. 22.2
c. 21.4
d. 6.0
e. 11.1

**14. The design and/or operation of an automated system used for scheduling.**

a. 33.3
b. 20.2
c. 20.2
d. 9.7
e. 16.5

**15. Extent of standardization in course titles/codes.**

a. 42.0
b. 15.1
c. 16.9
d. 8.0
e. 18.0

**16. Integrating scheduling with other training functions, such as record keeping and reporting.**

a. 35.0
b. 23.2
c. 21.2
b. 8.6
e. 12.0

**17. The extent of your training/preparation for doing scheduling functions.**

a. 47.4
b. 29.0
c. 14.4
d. 5.7
e. 3.4

18. Getting people to attend training as scheduled.

a. 25.4
b. 38.6
c. 23.7
d. 10.9
e. 1.4

19. Coordinating training schedules with other unit activities.

a. 35.8
b. 35.0
c. 21.2
d. 4.6
e. 3.4

## Section IV - Training Development

This section applies to individuals who currently plan or develop any training courses or exercises, either ancillary or job-related. Training development includes writing training objectives, testing standards, or tests; developing instructional materials; and other tasks directly related to creating training materials. At the unit level, this may be in special job-related training programs such as FTD or AMQP, ancillary training such as Self/Buddy Care or CPR, or special training directed by Commander/Supervisor such as introducing new equipment or policy.

If you are not involved in the development of training, go to Section V.

(225 (56%) responded)

**20. About what portion of your duty time is normally spent on training development?**

a. All or nearly all 6.2
b. About three-quarters 4.9
c. About half 12.0
d. About one-quarter 23.1
e. About 5 to 10 percent 29.8
f. Less than 5 percent 24.0

**21. Have you developed or assisted in developing any of the following? (Mark all that apply)**

a. Formal course(s) for Enlisted Specialty Training (EST) 10.0 (17.8)
b. Formal courses for ancillary training 12.5 (22.2)
c. Methods for on job training (OJT) 25.8 (63.6)
d. Exercises or examples to supplement formal courses 18.3 (32.4)
e. Mock-up or example equipment for use in training 11.3 (20.0)
f. Other 22.5 (40.0)

22. **What sources do you use to determine training content? (Mark all that apply)**

a. STS/AF Form 797 44.0 (78.2)
b. AFJQS 24.3 (43.1)
c. Command JQS 19.3 (34.2)
d. Master Task List 36.3 (64.4)
e. Occupational Survey Report 5.3 (9.3)
f. Unit level task analysis 18.8 (33.3)
g. MAJCOM training plans 12.5 (22.2)
h. Talking to functional managers about need for training 21.0 (37.3)
i. Past training evaluation reports 19.3 (34.2)
j. AF Form 1098 13.8 (24.4)
k. Technical orders (TOs) 18.5 (32.9)

23. **About what portion of the training materials used in your unit are developed within your unit?**

a. All or nearly all 14.4
b. About three-quarters 15.7
c. About half 20.8
d. About one-quarter 19.0
e. About 5 to 10 percent 26.4
f. None 3.7

24. **Which of the following steps do you usually do when developing training? (Mark all that apply)**

a. Conduct a training needs assessment 38.0 (67.6)
b. Select tasks requiring training 38.3 (68.0)
c. Develop objectives 37.3 (66.2)
d. Develop tests 28.8 (51.1)
e. Plan sequence of instruction 32.5 (57.8)
f. Select instructional methods 34.0 (60.4)
g. Select instructional media 28.8 (51.1)
h. Determine resource and funding requirements 22.0 (39.1)
i. Develop instructional materials 33.8 (60.0)

## Section V - Documentation

Questions 25 to 28 deal with maintaining documentation of student training activities (record keeping). If you do not routinely document training activity, skip to Section VI. (320 (80%) responded)

**25. About what portion of your time is normally spent on documentation?**

a. All or nearly all 3.4
b. About three-quarters 5.3
c. About half 11.9
d. About one-quarter 28.1
e. About 5 to 10 percent 31.6
f. Less than 5 percent 19.7

**26. How would you describe the system you currently use to document completed training?**

a. Fully automated. 20.7
b. Partially automated. 55.5
c. Fully manual. 23.8

**27. Is the written guidance for your documentation activities clear and easy to understand?**

a. Quite clear 42.0
b. Somewhat clear 32.9
c. Somewhat unclear 10.3
d. Very unclear 7.5
e. None available 7.2

**28. What hard-copy sources of information do you use for documentation? (Mark all that apply)**

a. AF Form 2426 47.0 (58.8)
b. Student/course training roster 42.8 (53.4)
c. Letters/memos of completion 46.8 (58.4)
d. Printouts received from some other source 46.5 (58.1)
e. Other 29.0 (36.3)

**29. What automated information systems do you use in documentation? (<u>Mark all that apply</u>)**

a. Personnel Data System (PDS) 13.0 (16.3)
b. CAMS 33.5 (41.9)
c. MMICS 1.8 (2.2)
d. CASB 0.3 (0.3)
e. MAJCOM-specific information system 6.3 (7.8)
f. Locally devised data base 24.8 (30.9)
g. Other 14.0 (17.5)
h. None. I do not use automated information systems 14.0 (17.5)

**Please use the following scale to rate each aspect of your documentation activity listed in Items 30 to 34. (Choose one response for <u>each</u> item)**

a. Not a problem at present - no improvement needed.
b. Only minor problems with this at present.
c. Some problems with this - improvement desirable.
d. Major problems with this - improvement urgently needed.
e. Not relevant to documentation.

**30. Access to existing data systems.**

a. 42.5
b. 26.4
c. 12.1
d. 6.8
e. 12.1

**31. Design and/or operation of automated system used for documentation.**

a. 35.8
b. 25.2
c. 14.0
d. 10.6
e. 14.3

**32. Extent of standardization in course titles/codes.**

a. 40.8
b. 18.1
c. 13.7
d. 8.1
e. 19.3

33. **Integrating documentation with other training functions, such as scheduling and reporting.**

a. 37.6
b. 26.1
c. 15.5
d. 9.6
e. 11.2

34. **Obtaining the needed information on attendance at training activities.**

a. 37.9
b. 29.8
c. 16.0
d. 8.2
e. 8.2

## Section VI - Reporting

Questions 35-39 apply to individuals who report training activity either by standardized or special reports. If you do not routinely report training activity, skip to Section VII. (302 (76%) responded)

35. **About what portion of your duty time is normally spent preparing and delivering reports?**

a. All or nearly all 2.3
b. About three-quarters 1.0
c. About half 5.0
d. About one-quarter 19.9
e. About 5 to 10 percent 38.1
f. Less than 5 percent 33.8

36. **For whom do you prepare reports: (Mark all that apply)**

a. Squadron level 62.3 (82.5)
b. Wing/base level 44.0 (58.3)
c. Numbered Air Force 5.0 (6.3)
d. MAJCOM 22.0 (27.5)
e. HQ USAF 2.5 (3.3)
f. Technical School 2.8 (3.6)
g. Other outside agencies 10.3 (12.8)

37. **Do you feel that the amount of reporting done in regard to training is: (Select one)**

a. Not enough 8.6
b. About right 67.4
c. Too much 23.9

38. **Which of the following types of reports do you deliver? (Mark all that apply)**

a. Oral (briefings) 47.8 (63.2)
b. Automated (computer) 34.8 (46.0)
c. Written 55.5 (73.5)
d. Standard format (fill in the blanks) 30.5 (40.4)

**39. How are the reports that you prepare used? (<u>Mark all that apply</u>)**

a. Remind airmen of their ancillary training requirements/schedules. 30.5 (40.4)
b. Check EST received against the required standards. 30.8 (40.7)
c. Analyze the effectiveness of training delivery.35.8 (47.4)
d. Analyze the trends in delivery of training. 30.8 (40.7)
e. Determine additional training requirements. 38.8 (51.3)
f. Determine training equipment requirements. 13.3 (17.5)
g. None of the above, or don't know. 13.8 (18.2)

## Section VII - Evaluation

This section deals with the evaluation of individual training or training courses. It does not refer to the initial evaluation of individuals entering Upgrade Training (UGT). It does refer to the evaluation of tasks leading to certification in UGT plus any other formal evaluation of training. (252 (63%) responded)

If you do not currently evaluate training, skip to Section VIII.

**40. About what portion of your duty time is spent on testing/evaluation activities?**

a. All or nearly all 2.4
b. About three-quarters 2.8
c. About half 9.5
d. About one-quarter 15.9
e. About 5 to 10 percent 38.1
f. Less than 5 percent 31.3

**41. Which of the following evaluation tasks do you do? (Mark all that apply)**

a. Administer/monitor performance tests 28.3 (44.8)
b. Administer/monitor written tests 38.8 (61.5)
c. Score tests 34.0 (54.0)
d. Record test results 36.3 (57.5)
e. Report test results 31.0 (49.2)
f. Develop/write test items 17.5 (27.8)
g. Design/assemble tests 16.5 (26.2)

**42. What sources of information are used to evaluate the delivery of training? (Mark all that apply)**

a. Student critiques 31.5 (50.0)
b. Course control documents (STS, JQS, POI) 27.0 (42.9)
c. Test scores of students 41.5 (65.9)
d. Job/task evaluations of students 33.0 (52.4)
e. Inspection results (IG, ORI, QA, etc.) 21.5 (34.1)
f. ISD reports/records 4.8 (7.5)
g. Local checklist/procedure 26.8 (42.5)
h. Other 11.5 (18.3)

**43. What sources of information are used to evaluate the results of training? (Mark all that apply)**

a. Student critiques 29.3 (46.4)
b. Course control documents (STS, JQS, POI) 25.3 (40.1)
c. Test scores of students 41.3 (65.5)
d. Job/task evaluations of students 35.0 (55.6)
e. Inspection results (IG, ORI, QA, etc.) 23.0 (36.5)
f. ISD reports/records 4.0 (6.3)
g. Local checklist/procedure 24.8 (39.3)
h. Other 8.8 (13.9)

**44. What measures are used to assess performance for the training you administer? (Mark all that apply)**

a. Observe graduate performance. 26.0 (41.2)
b. Question graduates about job performance. 20.3 (32.1)
c. Formal performance. 17.5 (27.8)
d. Interview supervisors of graduates. 21.0 (33.3)
e. Written exams. 21.8 (34.5)
f. No performance measures are used. 10.3 (16.3)
g. Other. 6.3 (9.9)

**45. What information, assistance, or methods would you like to have for use in your evaluation duties? (Mark all that apply)**

a. Formal methods of determining student performance. 13.3 (21.0)
b. Further training for how to evaluate performance. 19.5 (31.0)
c. A job-aid, such as computer program or video, to explain training evaluation. 27.3 (43.3)
d. A comprehensive checklist of what to evaluate. 25.3 (40.1)
e. Evaluation built into the course and certified by the instructor. 16.0 (25.4)
f. More explicit performance standards for the AFSCs in my unit. 20.8 (32.9)

**46. What computer based information systems or tools do you use in managing data from training evaluations? (Mark all that apply)**

a. None 24.3 ( 38.5)
b. Standard data base managing tools, such as Lotus 1-2-3, dBase or SAS 10.0 (15.9)
c. CAMS 15.8 (25.0)
d. MMICS 1.0 (1.6)
e. Locally devised system 15.3 (24.2)
f. Other 9.8 (15.5)

## Section VIII - Opinions About Training

This section asks for your own opinions about some aspects of the training that occurs within your unit. Please use the following scale, and choose one response for each item.

a. Strongly Agree
b. Agree
c. Disagree
d. Strongly Disagree
e. Not applicable to your unit; or Do not know.

**47. Standards for training in my unit go far beyond general Air Force standards.**

a. 6.6 d. 10.0
b. 33.9 e. 6.3
c. 43.3

**48. When technologies for managing training (e.g., automated systems) are introduced in our unit, they are used to full capacity.**

a. 14.7 d. 7.1
b. 38.4 e. 17.4
c. 22.4

**49. For the jobs in my unit, hands-on training is generally more effective than classroom training.**

a. 39.4 d. 3.1
b. 39.6 e. 3.7
c. 14.2

**50. Computer-assisted training technologies can be as effective as classroom training.**

a. 19.4 d. 6.3
b. 40.8 e. 11.5
c. 22.0

**51. My unit has sufficient resources to provide more training than it is currently conducting.**

a. 9.4 d. 13.1
b. 25.9 e. 8.6
c. 42.9

**52. For most AFSCs in my squadron, developing formal training courses could frequently be done at the squadron level.**

a. 6.5
b. 26.6
c. 38.5
d. 17.2
e. 11.2

**53. Training packages developed outside the unit (for example, at headquarters level or by contractors) are generally useful for squadron level training**

a. 7.0
b. 48.8
c. 15.9
d. 5.0
e. 23.2

**54. Contractors' technical representatives fill a crucial role in the accomplishment of technical training requirements within my squadron.**

a. 6.3
b. 17.9
c. 22.7
d. 11.1
e. 42.0

**55. Training devices and simulators are frequently used for training in our unit.**

a. 9.9
b. 25.3
c. 26.3
d. 9.9
e. 28.6

**56. Training devices and simulators are as effective as hands-on training using actual equipment.**

a. 14.3
b. 35.2
c. 22.7
d. 6.3
e. 21.6

## Section IX - Future Training

The following section describes a possible future situation.

At some time in the future the Air Force directs that, for most AFSCs, time available for formal technical school training will be reduced by half. Substantial training responsibilities are to be shifted to the base and squadron level. In order to accomplish this new tasking, base and squadron training and training management capabilities need to be enhanced.

Answer the following questions assuming that YOU have been tasked to help determine requirements at your base for supporting increased training responsibilities. As usual, these increased responsibilities must be supported with as small an increase in training manpower as possible. Do not base your responses on current regulations, operating policies, or capabilities.

**57. As part of the changeover to greater base and squadron level training responsibilities, primary responsibility for several tasks involved in determining training requirements will be moved to the base or squadron level. Which single task do you feel would most need highly modern computer based data management tools or techniques in order to be carried out effectively at the base or squadron level? (<u>Select one</u>)**

a. Conduct a training needs assessment 21.6
b. Analyze job performance requirements 23.2
c. Select tasks requiring training 8.8
d. Determine student prerequisites 2.9
e. Select appropriate training settings 1.9
f. Forecast resource/logistics requirements 15.5
g. Do not know 21.6

*58-60* **As part of the restructuring of training, the Air Force has directed base and squadron level training organizations to develop in-house capabilities to perform a number of tasks. Please use the following list to answer items 57-59.**

a. Develop training objectives
b. Develop knowledge tests
c. Develop performance tests
d. Plan sequence of instruction
e. Select instructional methods
f. Select instructional medias
g. Develop instructional materials
h. Validate the approach and content used
i. Do not know.

**58. If your unit were directed to perform all the above tasks, which of the tasks would be completely new responsibilities to the unit? (<u>Mark all that apply</u>)**

| | |
|---|---|
| a. 21.8 | f. 24.8 |
| b. 31.5 | g. 36.0 |
| c. 27.3 | h. 49.8 |
| d. 23.0 | i. 16.5 |
| e 19.3 | |

**59. Which one of the tasks listed above would be the single most difficult to implement without additional manpower, training, or equipment? (<u>Select one</u>)**

| | |
|---|---|
| a. 5.3 | f. 1.7 |
| b. 6.7 | g. 39.0 |
| c. 2.5 | h. 16.0 |
| d. 2.5 | i. 24.2 |
| e 2.0 | |

**60. For each of the tasks listed above, mark the ones which would require training personnel to receive additional training to perform. (<u>Mark all that apply</u>)**

| | |
|---|---|
| a. 34.8 | f. 30.8 |
| b. 43.3 | g. 53.0 |
| c. 39.8 | h. 51.8 |
| d. 34.0 | i. 14.8 |
| e 29.8 | |

*61-62* **As part of the new training strategy, the Air Force has directed that OJT be the primary method of job skills training. You have been tasked to provide additional training to all OJT instructors on teaching and assessment methods in the work environment.**

**61. If you were free to select any means of instructional delivery to teach OJT instructors (train the trainers), which of the following would you believe to be <u>most efficient</u> in terms of scheduling, record keeping, and other administrative tasks? <u>(Select one)</u>**

a. instructor-led classroom instruction 46.7
b. Videotaped "lectures" 7.9
c. Computer-based training 25.7
d. Self study printed materials 3.9
e. One-on-one work with OJT instructors 15.7

**62. Which one of the following means of instructional delivery would you feel to be the <u>most effective</u> for preparing OJT instructors to carry out their duties? <u>(Select one)</u>**

a. Instructor-led classroom instruction 52.0
b. Videotaped "lectures" 4.7
c. Computer-based training 12.1
d. Self study printed materials 2.1
e. One-on-one assistance to OJT instructors 29.1

**63-66 In support of the increased requirements for base and squadron level training, you are tasked to prepare a plan to support training. Please use the following list to answer items 63-66.**

a. Scheduling students
b. Scheduling resources
c. Tracking student progress
d. Managing training requirements
e. Maintaining instructional materials and equipment
f. Updating instructional materials and equipment
g. None of the above

63. For which of the tasks would you propose to continue to use current methods and procedures with little or no modification? (Mark all that apply)

a. 53.3
b. 36.3
c. 36.8
d. 35.5
e. 29.8
f. 19.5
g. 18.3

64. For each of the tasks listed above, mark the ones which would require training personnel to receive additional training to perform. (Mark all that apply)

a. 9.8
b. 20.8
c. 24.0
d. 37.5
e. 36.0
f. 58.0
g. 21.0

65. For which single task from the above list would automated record keeping prove to be most beneficial, given increased base and unit training requirements? (Select one)

a. 26.6
b. 4.3
c. 29.8
d. 24.9
e. 2.6
f. 7.7
g. 4.0

66. For which single task from the above list would you suggest that additional manpower would be needed regardless of the level of automation provided? (Select one)

a. 5.0
b. 2.8
c. 6.1
d. 19.3
e. 13.5
f. 36.2
g. 17.1

*67-69* In support of the increased requirements for base and squadron level training, evaluation responsibilities will be substantially increased. Please use the following list to answer items 66-68.

a. Evaluating student performance during training
b. Evaluating student performance on completion of training
c. Evaluating job performance during training
d. Evaluating job performance in relation to training performance
e. Measuring the usefulness and cost-benefits of various local training programs
f. Do not know

**67. Which of the evaluation responsibilities do you believe would prove to be the most difficult to implement at the base or squadron level? (Select one)**

| | |
|---|---|
| a. 2.9 | d. 14.9 |
| b. 1.6 | e. 59.7 |
| c. 5.9 | f. 14.9 |

**68. Which item listed above would require the fewest changes in procedures currently used at the base or squadron level? (Select one)**

| | |
|---|---|
| a. 29.0 | d. 8.2 |
| b. 26.1 | e. 4.5 |
| c. 16.0 | f. 16.2 |

**69. For which single task from the above list would automated record keeping prove to be most beneficial, given increased base and unit training requirements? (Select one)**

| | |
|---|---|
| a. 6.7 | d. 16.2 |
| b. 14.6 | e. 29.1 |
| c. 3.8 | f. 29.6 |

## Section X - Your Training Activities During Desert Shield/Desert Storm

We need to know more about how to plan for unit-level training in a wartime environment. Please answer this section in terms of your unit's training during the period of the conflict with Iraq, from August, 1990 to February, 1991. Answer this section whether or not you were deployed to the Middle East.

70. **During the conflict with Iraq, were you: (Mark all that apply)**

a. Deployed to the Middle East. 6.5
b. Deployed from CONUS to overseas, but to a location other than Middle East. 2.5
c. Deployed from overseas to CONUS. 0.5
d. Deployed within the U.S. 1.0
e. Did not move - remained in current location. 86.3

71. **If you deployed during the conflict, was this deployment with your unit or individually?**

a. Does not apply - did not deploy. 89.7
b. Deployed individually, not with my unit. 2.4
c. Deployed with part of my unit. 6.8
d. Deployed with entire unit. 1.1

72. **During the period of the conflict (from August 1990 to February 1991) did you manage any of the following types of training activities? (Mark all that apply)**

a. Normal OJT training. 66.0
b. Special OJT to learn how to operate/maintain equipment in the desert environment. 6.0
c. Special unit training to learn how to live in the desert environment. 3.8
d. Additional ancillary training for threats such as nuclear/chemical/biological warfare. 25.0
e. Training for working and living within an Arabic culture. 3.3
f. Normal ancillary training. 43.5
g. Did not manage training during that period. 22.5

73. **During the period of conflict, what part of your duty time was devoted to training management duties?**

a. All or nearly all 37.3
b. About three-quarters 10.4
c. About half 9.4
d. About one-quarter 8.6
e. About 5 to 10 percent 12.8
f. None 21.4

***74-80*** **During Desert Shield/Storm, what changes occurred in your unit's training? Please use the following responses to indicate what types of change occurred in each aspect of training listed in items 73 to 79. (Mark all that apply)**

a. Decreased
b. Increased
c. Waived part or all of normal activities
d. Postponed some or all
e. Changed method for doing this
f. Do not normally perform this
g. No changes in this item

74. **Formal job related training.**

a. 28.5
b. 11.5
c. 8.3
d. 16.8
e. 2.5
f. 3.8
g. 39.3

75. **Informal job related training.**

a. 17.0
b. 21.8
c. 6.5
d. 9.8
e. 3.8
f. 3.0
g. 41.0

76. **Ancillary training.**

a. 10.8
b. 29.5
c. 8.3
d. 12.5
e. 4.8
f. 3.0
g. 35.8

**77. Documentation of training.**

a. 15.3
b. 11.8
c. 5.0
d. 9.3
e. 2.0
f. 2.3
g. 54.3

**78. Use of automated training management systems.**

a. 12.5
b. 7.5
c. 3.3
d. 5.0
e. 1.3
f. 15.3
g. 53.5

**79. Direct combat-related training.**

a. 6.0
b. 29.5
c. 2.8
d. 2.5
e. 2.0
f. 24.3
g. 30.0

**80. Evaluation of training.**

a. 13.8
b. 10.5
c. 5.5
d. 7.8
e. 3.3
f. 4.0
g. 53.0

*Thank you* for completing this survey. Please return this survey form and your answer sheet to the person who gave them to you.

# Appendix B-2

# Trainer Survey Form

# *Squadron Level Training*

# *Survey Form*

# *For Unit-Level Trainers*

***Prepared For:***

Technical Training Research Division
Human Resources Directorate of the
Armstrong Laboratory
Brooks A.F.B., TX 78235-5601

***Prepared By:***

HAY Systems, Inc.
Suite 650
2000 M Street, N.W.
Washington, DC 20036

1 November 1991

***Version Number:***
***0003***

**To All Survey Participants:**

You have been selected to take part in a survey covering various aspects of training in the Air Force. This project is being sponsored by the Technical Training Research Division, Human Resources Directorate of the Armstrong Laboratory, Brooks AFB, TX.

The information will be used for research on training at Operational Units in the Air Force. Rapidly changing technology in a changing world requires that Air Force training be responsive. Your assistance with this survey will help us better understand the viewpoint of those involved in base level training and the on-site training process.

The information you provide will be kept in strictest confidence. The background information that you are asked to provide on the answer sheet will be used to help assure that, overall, the people completing this survey are representative of the total population in the Air Force.

---

Privacy Act Statement

Authority: 5 USC Sec 301, EO9397, and AFR 35-2

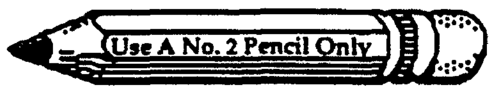
Principal Purpose: Collection of information concerning training program development and evaluation. SSAN for positive identifications.

Routine Area: Personnel research and personnel management system applications.

Disclosure: Failure to complete this requirement will detract from the Air Force's capability to carry out programs listed above.

# *Squadron Level Training Survey Form*

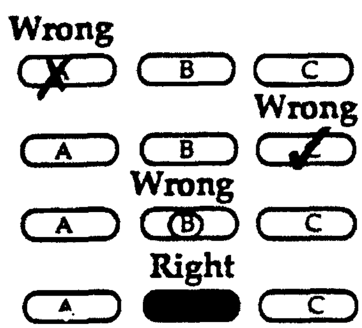
## Instructions For Completing The Questionnaire




- You should have two sharpened pencils and an eraser.
- Mark all answers on the answer sheet only.

### Do Not Mark On The Survey Forms

- Make heavy black marks that fill the oval completely. (See examples at right, which show both correctly and incorrectly marked answer spaces.)
- Fill in just one oval unless you are given instructions to mark all that apply.
- If you wish to change an answer, erase completely.
- Make no stray marks on the answer sheet.




### *Filling In The Answer Sheet*

**Do Not Fill In Your Name or Date of Birth**

Before answering any of the survey questions, fill in the following information in the spaces as indicated.

**Name Grid:**

- Using LIST A on the following page, enter the letter that matches the major command, field operating agency, or direct reporting unit in the first column of the Last Name section of your answer sheet.
- Using LIST B on the following page, enter the letter that matches the type of unit to which you are assigned in the first column of the First Name section of your answer sheet.

**Social Security Number Grid:**

- Fill in your Social Security Number.

**"Grid" Grid:**

- Fill in the Version Number located in the lower right corner of the Survey form cover sheet; use all four columns, for example, 0004.

Be sure to fill in the information as shown in the Grid-Marking Example shown on the lower right hand corner of side one of your answer sheet.
Starting in row 1 of your answer sheet fill in your responses. This survey should take you less than one hour to complete.
After completion of this survey, return the survey form and the answer sheet to the person who gave you these materials.

## LIST A

## AIR FORCE MAJOR COMMANDS, FIELD OPERATING AGENCIES, AND DIRECT REPORTING UNITS

Enter the LETTER that matches your selection on the first Column of the Last Name section of your answer sheet.

A. Air Force Logistics Command (AFLC) 3.6
B. Air Force Systems Command (AFSC) 4.9
C. Air Force Space Command (AFSPACECOM) 0.0
D. Air Training Command (ATC) 1.5
E. Air University (AU) 2.5
F. Electronic Security Command (ESC) 3.6
G. Military Airlift Command (MAC) 12.6
H. Strategic Air Command (SAC) 19.8
I. Tactical Air Command (TAC) 16.5
J. Air Force Combat Operations Staff (AFCOS) 0.0
K. Air Force Communications Agency (AFCA) 1.7
L. Defense Agency 0.0
M. Air Force District of Washington (AFDW) 0.2
N. Air Force Inspection Center (AFIC) 0.3
O. Air Force Intelligence Agency (AFIA) 0.3
P. Air Force Legal Services Center (AFLSC) 0.2
Q. Air Force Management Engineering Agency (AFMEA) 0.0
R. Air Force Military Personnel Center (AFMPC) 0.0
S. Air Force Morale, Welfare, and Recreation Agency (AFMWRA) 0.1
T. Air Force Office of Medical Support (AFOMS) 0.4
U. Air Force Office of Security Police (AFOSP) 0.9
V. Air Force Office of Special Investigations (AFOSI) 0.1
W. Air Force Operational Test and Evaluation Center (AFOTEC) 0.1
X. Air Force Safety Center 0.0
Y. US Air Force Academy (USAFA) 0.0
Z. Other 29.7

(USAFE 19.7%)
(PACAF 7.0%)

## LIST B

## DESCRIPTION OF UNIT OF ASSIGNMENT

Enter the LETTER that matches your selection on the first Column of the First Name section of your answer sheet.

A. Aircraft Maint 27.3
B. Audiovisual 0.1
C. Audit 0.0
D. Chaplain 0.1
E. Civil Engnrg 7.0
F. Communications 9.3
G. Comptroller 1.1
H. Eduation 0.7
I. Flying Sqn 2.7
J. Info Mgmt 2.5
K. Legal 0.5
L. Manpower 0.2
M. Medical 4.6
N. Missile Sqn 2.7
O. MWR 0.2
P. Personnel 1.3
Q. Public Affairs 0.1
R. Safety 0.2
S. Security Police 7.0
T. Services 1.2
U. Social Actions 0.2
V. Supply 4.5
W. Transportation 3.4
X. Training 1.4
Y. Weather 0.2
Z. Other 20.2

## Section I - Demographics

**Please do not proceed until you have completed the section entitled "Filling In The Answer Sheet".**

1. **Your grade:**

   a. E-3 Airman First Class 0
   b. E-4 Senior Airman/Sergeant 0.4
   c. E-5 Staff Sergeant 1.2
   d. E-6 Technical Sergeant 54.9
   e. E-7 Master Sergeant 41.8
   f. E-8 Senior Master Sgt 1.5
   g. E-9 Chief Master Sgt 0.1
   h. G-S Civilian 0
   i. W-G Civilian 0

2. **Years on Active Duty (Military); years with Civil Service (Civilians):**

   a. 1 to 4 years 0
   b. 4 to 8 years 0.5
   c. 8 to 12 years 11.4
   d. 12 to 16 years 40.0
   e. Over 16 years 48.1

   99.5% = or more
   88.1% = 12 or more
   48.1% = 16 or more

3. **Your current role in the training process is: (Mark all that apply)**

   a. Instructor (Classroom, does not include OJT Trainer) 10.2
   b. OJT Trainer 63.8
   c. Ancillary Training Trainer 9.4
   d. Squadron training monitor 2.4
   e. Section training monitor/coordinator 38.2
   f. Squadron OJT monitor 1.1

## Section II - OJT Trainer/Supervisor

Complete this section only if you are currently designated as an OJT Trainer on a Trainee's AF Form 623 or other approved form, or if you are a supervisor with overall OJT responsibility for a section. If you are not an OJT Trainer/Supervisor, proceed to Section III.

(1155 (83.8%) responded)

**4. For how many individuals do you serve as OJT trainer?**

a. One 14.7
b. Two 15.7
c. Three 12.7
d. More than three 39.1
e. OJT supervisor only 17.7

**5. How were you trained or qualified as an OJT trainer?** (<u>Mark all that apply</u>)

a. ATC Technical Instructor Course 8.0 (9.6)
b. OJT trainer/Supervisors Course (FTD) 62.9 (75.2)
c. Military instructor course (TAC Maintenance Instructor Course, AIC, etc.) 3.3 (4.0)
d. Civilian education/training experience 9.5 (11.3)
e. Professional Military Education (PME) 42.1 (50.2)
f. On-the-job experience only (<u>do not</u> select any others above) 17.8 (21.3)

**6. Approximately what proportion of your duty time is normally spent in providing and/or supervising on-the-job training?**

a. All or nearly all 2.9
b. About three-quarters 4.5
c. About half 15.2
d. About one-quarter 25.9
e. About 5 to 10 percent 32.0
f. Less than 5 percent 19.4

7. **How long have you been an OJT trainer/supervisor?**

   a. One year or less 7.1
   b. One to three years 7.5
   c. Three to five years 7.3
   d. More than five years 78.1

8. **When entering your section, a person receives an initial training evaluation by: (Mark all that apply)**

   a. Section supervisor 52.4 (62.5)
   b. Myself as OJT Trainer 41.6 (49.6)
   c. Another OJT Trainer 18.3 (21.8)
   d. Section training coordinator/monitor 20.8 (24.8)
   e. Squadron OJT monitor 14.1 (16.8)
   f. None of the above 3.2 (3.8)

9. **During the initial evaluation, what sources are used to determine the student's training needs: (Mark all that apply)**

   a. Initial evaluations not usually conducted 4.1 (4.8)
   b. Previous training records (AF Form 623, AF Form 797, etc.) 67.5 (80.6)
   c. Computer products (CAMS, CASB, MMICS, APDS, etc.) 34.0 (40.6)
   d. Training Standards (STS, AFJQS, CJQS) 56.1 (66.9)
   e. Workcenter Master Task List (MTL) 44.0 (52.6)
   f. Interview (discuss student's qualifications) 58.8 (70.2)
   g. Over-the-shoulder evaluation 20.9 (24.9)
   h. Written test 5.1 (6.1)
   i. Trainer assessment 26.1 (31.2)
   j. Performance/Product evaluation 24.6 (29.3)

10. **How are task evaluations most often completed? (Select One)**

   a. Trainer/supervisor over-the-shoulder evaluation 63.5
   b. Informal (asking questions concerning the task) 22.2
   c. Outside (third party) evaluation (e.g., another section/unit) 4.5
   d. Outside agency evaluation (e.g. Quality Assurance) 8.5
   e. Paper and pencil testing 1.3

**Please use the following scale to rate each aspect of OJT training in items 11-20.**

a. Not a problem at present – no improvement needed
b. Only minor problems with this at present
c. Some problems with this – improvement desirable
d. Major problems with this – improvement urgently needed

**11. Availability of appropriate written training materials (such as training packages, texts, manuals, tech orders, forms).**

a. 48.9
b. 25.4
c. 19.6
d. 6.1

**12. Availability, when needed, of training facilities and equipment such as classrooms, aircraft and mock-ups.**

a. 53.9
b. 22.4
c. 17.3
d. 6.4

**13. Availability of equipment for presenting individual training, such as computers, VCRs, and simulators.**

a. 56.5
b. 22.7
c. 15.6
d. 5.2

**14. Maintenance and repair of equipment used in training, such as mock-ups, computers, VCRs, IVDs, or simulators.**

a. 61.9
b. 22.1
c. 11.2
d. 4.7

**15. Having enough time to perform my training duties.**

a. 37.0
b. 28.6
c. 24.0
d. 10.3

**16. Trainees available for required training.**

a. 52.5
b. 28.5
c. 13.8
d. 5.2

**17. Appropriateness of externally produced training materials for use at the unit level.**

a. 48.6
b. 26.2
c. 18.9
d. 6.3

**18. Integrating job skills training with other mission requirements.**

a. 48.3
b. 31.6
c. 15.1
d. 5.1

**19. Training on tasks that are not performed very often.**

a. 30.5
b. 37.1
c. 23.6
d. 8.7

**20. OJT keeping up with changes in technology used for the job.**

a. 40.3
b. 31.4
c. 20.3
d. 8.0

## Section III - Training Development

This section applies to individuals who currently plan or develop training courses or exercises, either ancillary or job-related. At the unit level, this may be in special job-related training programs such as FTD or AMQP, ancillary training such as Self/Buddy Care or CPR, or special training directed by Commander/Supervisor such as introducing new equipment or policy.

If you are not involved in the development of training, go to Section IV.

(588 (43%) responded)

**21. What portion of your duty time, overall, is spent on the development of training?**

a. All or nearly all 3.2
b. About three-quarters 5.6
c. About half 9.2
d. About one-quarter 22.3
e. About 5 to 10 percent 33.0
f. Less than 5 percent 26.7

22. What types of training do you develop or help to develop? (Mark all that apply)

a. Formal courses 5.1 (12.1)
b. OJT 23.8 (55.8)
c. Exercises or examples to supplement formal courses 12.4 (29.1)
d. Simulations 10.6 (24.8)
e. Field exercises 12.2 (28.6)
f. Other 13.6 (32.0)

23. What sources do you use to determine training content? (Mark all that apply)

a. STS 27.4 (64.3)
b. AFJQS 11.9 (27.9)
c. Command JQS 10.1 (23.6)
d. Master Task List 22.1 (51.9)
e. Occupational Survey Report 1.4 (3.2)
f. Unit-level task analysis 8.6 (20.1)
g. MAJCOM training plans 5.5 (12.9)
h. Talking to functional managers about need for training 8.4 (19.7)
i. Training evaluation reports 6.9 (16.2)
j. Content determined by higher level or headquarters 8.1 (19.0)
k. Other 11.8 (27. 7)
l. Don't know 0.8 (1.9)

24. About what portion of the training materials used in your training activities are developed locally?

a. All or nearly all 27.4
b. About three quarters 14.7
c. About half 23.9
d. About one quarter 13.1
e. About 5 to 10 percent 15.2
f. None 5.7

**25. Which of the following steps do you usually do when developing training? (Mark all that apply)**

a. Conduct a training needs assessment 25.7 (60.4)
b. Select tasks requiring training 31.1 (73.0)
c. Develop objectives 28.5 (66.8)
d. Develop tests 18.2 (42.7)
e. Plan sequence of instruction 24.1 (56.6)
f. Select instructional methods 21.9 (51.4)
g. Select instructional media 14.1 (33.2)
h. Determine resource and funding requirements 8.3 (19.4)
i. Develop instructional materials 19.4 (45.4)

## Section IV - Training Delivery

Training delivery refers to the actual presentation of a training class or course. The training might be formal or informal, job-related or ancillary. If you do not deliver training, skip to Section V.

(793 (58%) Responded)

**26. Is presentation of training your:**

a. Primary duty 7.2
b. Part of your primary duty 52.9
c. Assigned additional duty 27.8
d. Volunteer additional duty 12.1

**27. What portion of your time, overall, is normally spent in delivering training?**

a. All or nearly all 2.4
b. About three-quarters 3.7
c. About half 12.9
d. About one-quarter 24.5
e. About 5 to 10 percent 35.8
f. Less than 5 percent 20.8

***28-35*** **Please use this set of responses to indicate how frequently you use each of the following methods when delivering training:**

a. Use this method with nearly all trainees
b. Use method with about half of trainees
c. Use method with about a quarter of trainees
d. Have used this method, but rarely
e. Never used this method

**(Choose one response for *EACH* item).**

**28. Hands-on and over-the-shoulder instruction.**

a. 77.6
b. 9.0
c. 7.3
d. 3.0
e. 3.0

**Assign self-paced instruction using written materials, such as texts, references or manuals.**

a. 32.0 d. 27.6
b. 10.4 e. 18.6
c. 11.4

30. **Group of trainees study written materials, such as CDCs, together.**

a. 9.0 d. 26.0
b. 4.4 e. 54.2
c 6.3

31. **Computer-assisted instruction (CAI).**

a. 8.9 d. 17.9
b. 3.5 e. 63.1
c. 6.7

32. **Interactive video disks (IVD).**

a. 2.3 d. 11.9
b. 2.6 e. 78.8
c. 4.5

33. **Video cassette recordings (VCR).**

a. 14.4 d. 24.6
b. 7.4 e. 44.6
c. 8.9

34. **Simulators or mock-ups.**

a. 18.4 d. 18.2
b. 6.8 e. 46.8
c. 9.8

35. **Lecture/presentation in a classroom setting.**

a. 33.1 d. 20.6
b. 13.2 e. 21.2
c. 12.0

**36-43 Please rate each of the following teaching methods in terms of how effective the method is for helping the average trainee learn the tasks. Use the following scale in rating each method:**

a. Very effective - trainees learn quickly with this method
b. Effective
c. Somewhat effective
d. Somewhat ineffective
e. Ineffective
f. Very ineffective – trainees learning a task with this method usually must be re-taught
g. No experience with method

**(Choose one response for each item)**

**36. Hands-on and over-the-shoulder instruction.**

| | | | |
|---|---|---|---|
| a. | 73.4 | e. | 0.8 |
| b. | 20.2 | f. | 0.4 |
| c. | 4.0 | g. | 0.9 |
| d. | 0.2 | | |

**37. Self-paced instruction using written materials, such as texts, references or manuals.**

| | | | |
|---|---|---|---|
| a. | 6.5 | e. | 3.2 |
| b. | 32.7 | f. | 2.1 |
| c. | 38.1 | g. | 9.3 |
| d. | 8.0 | | |

**38. Group study of written materials.**

| | | | |
|---|---|---|---|
| a. | 5.4 | e. | 6.4 |
| b. | 21.0 | f. | 2.1 |
| c. | 29.1 | g. | 27.2 |
| d. | 8.7 | | |

**39. Computer-assisted instruction (CAI).**

| | | | |
|---|---|---|---|
| a. | 4.4 | e. | 3.1 |
| b. | 14.5 | f. | 1.5 |
| c. | 16.0 | g. | 56.3 |
| d. | 4.2 | | |

**40. Interactive video disks (IVD).**

a. 2.5
b. 7.2
c. 11.6
d. 3.6
e. 4.1
f. 1.3
g. 69.7

**41. Video cassette recordings (VCR).**

a. 4.8
b. 20.7
c. 27.1
d. 7.0
e. 3.9
f. 1.1
g. 35.5

**42. Simulators or mock-ups.**

a. 19.6
b. 23.4
c. 13.5
d. 1.7
e. 2.8
f. 0.4
g. 38.7

**43. Lecture/presentation.**

a. 11.3
b. 35.4
c. 32.0
d. 5.4
e. 2.8
f. 1.4
g. 11.6

***44-51*** **Please rate each training delivery method below in terms of its reliability. By reliability, we mean whether the method is always available for use, whether instruction is consistent using the method, and whether breakdowns, malfunctions or non-availability occur. Please use the following scale to rate each method:**

a. Very reliable - no problems with it
b. Reliable
c. Somewhat reliable - some problems occur with it
d. Unreliable - problems frequently occur
e. Very unreliable
f. Never used this method

**(Choose <u>one</u> response for <u>each</u> item)**

**44. Hands-on and over-the-shoulder instruction.**

| | |
|---|---|
| a. 61.8 | d. .8 |
| b. 30.9 | e. .1 |
| c. 5.3 | f. 1.1 |

**45. Self-paced instruction using written materials, such as texts, references or manuals.**

| | |
|---|---|
| a. 10.8 | d. 6.7 |
| b. 31.6 | e. 2.6 |
| c. 38.9 | f. 9.3 |

**46. Group study of written materials.**

| | |
|---|---|
| a. 5.2 | d. 8.8 |
| b. 19.8 | e. 5.6 |
| c. 33.4 | f. 27.2 |

**47. Computer-assisted instruction (CAI).**

| | |
|---|---|
| a. 4.1 | d. 4.7 |
| b. 12.2 | e. 3.8 |
| c. 18.0 | f. 57.2 |

**48. Interactive video disks (IVD).**

| | |
|---|---|
| a. 1.7 | d. 4.3 |
| b. 6.9 | e. 4.6 |
| c. 12.8 | f. 69.7 |

49. Video cassette recordings (VCR).

| | |
|---|---|
| a. 5.9 | d. 4.0 |
| b. 23.3 | e. 3.1 |
| c. 28.1 | f. 35.7 |

50. Simulators or mock-ups.

| | |
|---|---|
| a. 12.7 | d. 2.9 |
| b. 26.6 | e. 2.4 |
| c. 16.9 | f. 38.5 |

51. Lecture/presentation.

| | |
|---|---|
| a. 16.4 | d. 4.0 |
| b. 35.8 | e. 1.7 |
| c. 30.3 | f. 11.8 |

## Section V - Opinions About Training

**This section asks for your own opinions about some aspects of training methods and training delivery at your base. Please use the following scale:**

a. Strongly agree
b. Agree
c. Disagree
d. Strongly disagree
e. Not applicable or don't know

(Choose one response for each item)

**52. I feel confident that I am technically qualified to be a trainer.**

a. 56.5 d. 0.8
b. 38.1 e. 1.2
c. 3.3

**53. I feel confident in my teaching skills.**

a. 51.1 d. 0.4
b. 45.0 e. 1.0
c. 2.6

**54. The training media/methods available today are adequate for my needs.**

a. 15.3 d. 4.7
b. 60.3 e. 2.7
c. 17.1

**55. Training needs that I deal with are continually changing, so it is difficult to plan for the future.**

a. 10.3 d. 8.3
b. 28.5 e. 4.4
c. 48.5

**56. Standards for training in my unit go far beyond general Air Force standards.**

a. 10.8 d. 9.4
b. 29.7 e. 5.4
c. 44.8

57. **When technologies for training delivery (e.g., automated systems) are introduced in our unit, they are used to full capacity.**

a. 7.0
b. 35.1
c. 26.6
d. 7.5
e. 23.7

58. **For the jobs in my unit, hands-on training is generally more effective than classroom training.**

a. 52.0
b. 38.8
c. 6.4
d. 1.0
e. 1.7

59. **Computer-assisted training technologies can be as effective as classroom training.**

a. 11.1
b. 41.0
c. 19.9
d. 4.1
e. 23.8

60. **This unit has sufficient resources to provide more training than it is currently conducting.**

a. 9.7
b. 27.9
c. 40.5
d. 10.7
e. 11.2

61. **Training packages developed outside the unit (for example, at headquarters level or by contractors) are generally useful for squadron level training.**

a. 3.3
b. 45.1
c. 24.0
d. 7.7
e. 19.9

62. **Contractors' technical representatives fill a crucial role in the accomplishment of technical training requirements within my squadron.**

a. 4.6
b. 15.0
c. 27.8
d. 13.9
e. 38.8

**63. Training devices and simulators are used frequently for training in my unit.**

a. 7.3
b. 28.9
c. 28.5
d. 12.4
e. 22.9

## Section VI - Future Training

The following section describes a possible future situation.

At some time in the future the Air Force directs that, for most AFSCs, time available for formal technical school training will be reduced by half. Substantial training responsibilities are to be shifted to the base and squadron level. In order to accomplish this new tasking, base and squadron training and training management capabilities need to be enhanced.

Answer the following questions assuming that YOU have been tasked to help determine requirements at your base for supporting increased training responsibilities As usual, these increased responsibilities must be supported with as small an increase in training manpower as possible. Do not base your responses on current regulations, operating policies, or capabilities.

***64-66* As part of the restructuring of training, Air Force has directed base and squadron level training organizations to develop in-house capabilities. Please use the following list to answer items 64-66.**

a. Develop training objectives
b. Develop knowledge tests
c. Develop performance tests
d. Plan sequence of instruction
e. Select instructional methods
f. Select instructional media
g. Determine resource and funding requirements
h. Develop instructional materials
i. Validate the approach and content used
j. Do not know

**64. If your unit has been directed to perform all the above tasks, which of the tasks listed above would be completely new responsibilities to the unit? (Mark all that apply)**

| | | | |
|---|---|---|---|
| a. | 13.8 | f. | 19.8 |
| b. | 25.6 | g. | 39.7 |
| c. | 20.4 | h. | 25.7 |
| d. | 16.0 | i. | 32.1 |
| e. | 14.7 | j. | 29.5 |

**65. Which one of the tasks, given above would be the single most difficult to implement without additional manpower, training, or equipment? (<u>Select one</u>)**

| | | | |
|---|---|---|---|
| a. | 2.7 | f. | 3.7 |
| b. | 3.6 | g. | 19.3 |
| c. | 3.4 | h. | 24.4 |
| d. | 2.0 | i. | 9.9 |
| e. | 1.8 | j. | 29.1 |

**66. For each of the tasks listed, mark the ones which would require training personnel to receive additional training to perform. (<u>Mark all that apply</u>)**

| | | | |
|---|---|---|---|
| a. | 20.2 | f. | 21.9 |
| b. | 27.3 | g. | 43.7 |
| c. | 25.3 | h. | 36.8 |
| d. | 20.8 | i. | 36.4 |
| e. | 19.1 | j. | 25.0 |

***67-68*** **As part of the new training strategy, Air Force has directed that OJT be the primary method of job skills training beyond technical school. You have been tasked to provide additional training to all OJT instructors on teaching and assessment methods in the work environment.**

**67. If you were free to select any means of instructional delivery to teach OJT instructors (train the trainers), which of the following would you believe to be <u>most efficient</u> in terms of scheduling, record keeping, and other administrative tasks? (<u>Select one</u>)**

a. Instructor-led classroom instruction 62.3
b. Videotaped "lectures" 7.6
c. Computer-based training 22.2
d. Self study printed materials 8.0

**68. Which of the following means of instructional delivery would you feel to be the <u>most effective</u> for preparing OJT instructors to carry out their duties? (<u>Select one</u>)**

a. Instructor-led classroom instruction 77.1
b. Videotaped "lectures" 6.2
c. Computer-based training 11.3
d. Self study printed materials 5.4

**69-72 In support of the increased requirements for base and squadron level training, you are tasked to prepare a plan to administer and conduct training. Please use the following list to answer items 69-72.**

a. Scheduling students
b. Scheduling resources
c. Tracking student progress
d. Managing training requirements
e. Maintaining instructional materials and equipment
f. Updating instructional materials and equipment
g. Do not know

**69. For which of the tasks listed above would you propose to continue to use current methods and procedures with little or no modification? (Mark all that apply)**

| | |
|---|---|
| a. 47.7 | e. 32.0 |
| b. 34.1 | f. 23.6 |
| c. 40.9 | g. 23.6 |
| d. 34.7 | |

**70. For each of the tasks listed above, mark the ones which would require training personnel to receive additional training to perform. (Mark all that apply)**

| | |
|---|---|
| a. 9.9 | e. 31.8 |
| b. 18.7 | f. 48.4 |
| c. 20.7 | g. 26.4 |
| d. 36.5 | |

**71. For which single task from the above list would automated record keeping prove to be most beneficial, given increased base and unit training requirements? (Select one)**

| | |
|---|---|
| a. 15.3 | e. 4.2 |
| b. 4.3 | f. 8.4 |
| c. 33.8 | g. 15.9 |
| d. 18.1 | |

72. **For which <u>single</u> task from the above list would you suggest that additional manpower would be needed regardless of the level of automation provided? (<u>Select one</u>)**

| | |
|---|---|
| a. 2.9 | e. 20.0 |
| b. 3.0 | f. 27.0 |
| c. 6.5 | g. 23.8 |
| d. 16.9 | |

**73-75 In support of the increased requirements for base and squadron level training, evaluation responsibilities will be substantially increased. Please use the following list to answer questions 73-75.**

a. Evaluating student performance during training.
b. Evaluating student performance on completion of training.
c. Evaluating job performance during training.
d. Evaluating job performance in relation to training performance.
e. Measuring the usefulness and cost-benefits of various local training programs.
f. None of the above.

73. **Which one of the evaluation responsibilities listed do you believe would prove to be the most difficult to implement at the base or squadron level? (<u>Select one</u>)**

| | |
|---|---|
| a. 3.2 | d. 7.7 |
| b. 3.3 | e. 66.0 |
| c 3.0 | f. 16.8 |

74. **For which of the tasks listed would you propose to continue to use current methods and procedures with little or no modification? (<u>Mark all that apply</u>)**

| | |
|---|---|
| a. 56.9 | d. 32.8 |
| b. 50.0 | e. 8.3 |
| c 48.4 | f. 15.5 |

75. **For which single task would automated record keeping prove to be most beneficial, given increased base and unit training requirements? (<u>Select one</u>)**

| | |
|---|---|
| a. 9.0 | d. 11.9 |
| b. 11.4 | e. 35.0 |
| c 4.4 | f. 28.3 |

## Section VII- Your Training Activities During Desert Shield/Desert Storm

We need to know more about how to plan for unit-level training in a wartime environment. Please answer this section in terms of your unit's training during the period of the conflict with Iraq, from August, 1990 to February, 1991. Answer this section whether or not you were deployed to the Middle East.

**76. In support of the conflict with Iraq, were you: (Mark all that apply)**

a. Deployed to the Middle East. 14.2
b. Deployed from CONUS to overseas, but to a location other than Middle East. 4.6
c. Deployed from overseas to CONUS. 0.5
d. Deployed within the U.S. 1.8
e. Did not deploy - remained in current location. 78.4

**77. If you deployed in support of the conflict, was this deployment with your entire unit, part of your unit, or individually?**

a. Does not apply - did not deploy. 79.9
b. Individually, not with my unit. 3.8
c. With part of my unit. 14.0
d. With entire unit. 2.3

**78. During the period of the conflict (from August 1990 to February 1991) which of the following types of training did you provide? (Mark all that apply)**

a. Normal OJT training. 53.9
b. Special OJT to operate/maintain equipment in the desert environment. 7.9
c. Special unit training to learn to live in the desert environment. 5.3
d. Additional ancillary training for threats such as nuclear/chemical/biological warfare. 15.7
e. Training for working and living within an Arabic culture. 3.5
f. Normal ancillary training. 22.0
g. Other training. 18.9
h. None. 24.4

79. **During the period of conflict, the time that was devoted to training:**

a. Increased substantially 10.6
b. Increased slightly 16.0
c. Did not change 40.7
d. Decreased slightly 9.2
e. Decreased substantially 13.5
f. Stopped. No training given during this period. 9.9

*80-87* **During Desert Shield/Storm, what changes occurred in your unit's training? Please use the following responses to indicate what types of changes occurred in each aspect of training listed in items 80 to 87. (Mark all that apply for each item)**

a. Decreased
b. Increased
c. Waived part or all of normal activities
d. Postponed some or all
e. Changed method for doing this
f. Do not normally perform this training
g. Not applicable; did not change

80. **Formal job related training (such as classroom instruction).**

a. 19.4
b. 7.5
c. 6.6
d. 13.1
e. 2.2
f. 10.3
g. 47.1

81. **Informal job related training (such as unit meetings, word of mouth, etc.).**

a. 10.0
b. 28.6
c. 3.0
d 5.6
e. 2.0
f. 3.7
g. 46.8

82. **CDCs.**

a. 7.5
b. 2.1
c. 4.0
d 9.5
e. 1.1
f. 5.3
g. 69.0

**83. Ancillary training.**

a. 10.4
b. 17.8
c. 5.1
d 10.2
e. 2.2
f. 4.5
g. 50.1

**84. Documentation of training.**

a. 10.7
b. 6.7
c. 4.6
d 5.7
e. 2.4
f. 2.5
g. 66.0

**85. Use of automated training delivery systems.**

a. 7.9
b. 4.4
c. 3.0
d 4.0
e. 1.5
f. 15.4
g. 62.7

**86. Direct combat-related training.**

a. 3.7
b. 27.7
c. 1.5
d 2.5
e. 1.4
f. 14.6
g. 47.1

**87. Evaluation of training.**

a. 12.1
b. 9.1
c. 4.8
d 5.0
e. 3.7
f. 2.4
g. 60.8

**88. How well trained were you for your duties during Desert Storm (i.e. were you trained on the right things)?**

a. Well trained 57.1
b. Somewhat well trained 26.3
c. Little useful training 5.9
d. No useful training 10.7

*Thank you* for completing this survey. Please return this survey form and your answer sheet to the person who gave them to you.

# Appendix B-3

# Trainee Survey Form

# *Squadron Level Training Survey Form For Recipients of Training*

*Prepared For:* Technical Training Research Division
Human Resources Directorate of the
Armstrong Laboratory
Brooks A.F.B., TX 78235-5601

*Prepared By:* HAY Systems, Inc.
Suite 650
2000 M Street, N.W.
Washington, DC 20036

1 November 1991

***Version Number:***
***0004***

**To All Survey Participants:**

You have been selected to take part in a survey covering various aspects of training in the Air Force. This project is being sponsored by the Technical Training Research Division, Human Resources Directorate of the Armstrong Laboratory, Brooks AFB, TX.

The information will be used for research on training at Operational Units in the Air Force. Rapidly changing technology in a changing world requires that Air Force training be responsive. Your assistance with this survey will help us better understand the viewpoint of those involved in base level training and the on-site training process.

The information you provide will be kept in strictest confidence. The background information that you are asked to provide on the answer sheet will be used to help assure that, overall, the people completing this survey are representative of the total population in the Air Force.

---

Privacy Act Statement

Authority: 5 USC Sec 301, EO9397, and AFR 35-2

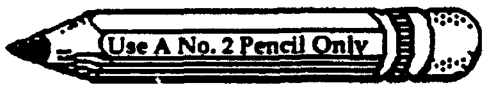
Principal Purpose: Collection of information concerning training program development and evaluation. SSAN for positive identifications.

Routine Area: Personnel research and personnel management system applications.

Disclosure: Failure to complete this requirement will detract from the Air Force's capability to carry out programs listed above.

# *Squadron Level Training Survey Form*

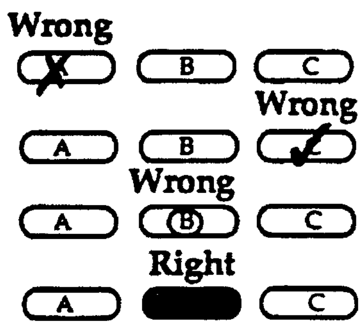
## Instructions For Completing The Questionnaire




- You should have two sharpened pencils and an eraser.
- Mark all answers on the answer sheet only.

### Do Not Mark On The Survey Forms

- Make heavy black marks that fill the oval completely. (See examples at right, which show both correctly and incorrectly marked answer spaces.)
- Fill in just one oval unless you are given instructions to mark all that apply.
- If you wish to change an answer, erase completely.
- Make no stray marks on the answer sheet.




### *Filling In The Answer Sheet*

**Do Not Fill In Your Name or Date of Birth**

Before answering any of the survey questions, fill in the following information in the spaces as indicated.

Name Grid:

- Using LIST A on the following page, enter the letter that matches the major command, field operating agency, or direct reporting unit in the first column of the Last Name section of your answer sheet.
- Using LIST B on the following page, enter the letter that matches the type of unit to which you are assigned in the first column of the First Name section of your answer sheet.

Social Security Number Grid:

- Fill in your Social Security Number.

"Grid" Grid:

- Fill in the Version Number located in the lower right corner of the Survey form cover sheet; use all four columns, for example, 0004.

Be sure to fill in the information as shown in the Grid-Marking Example shown on the lower right hand corner of side one of your answer sheet.
Starting in row 1 of your answer sheet fill in your responses. This survey should take you less than one hour to complete.
After completion of this survey, return the survey form and the answer sheet to the person who gave you these materials.

## LIST A

## AIR FORCE MAJOR COMMANDS, FIELD OPERATING AGENCIES, AND DIRECT REPORTING UNITS

Enter the LETTER that matches your selection on the first Column of the Last Name section of your answer sheet.

A. Air Force Logistics Command (AFLC) 2.7
B. Air Force Systems Command (AFSC) 5.0
C. Air Force Space Command (AFSPACECOM) 0.1
D. Air Training Command (ATC) 1.5
E. Air University (AU) 1.5
F. Electronic Security Command (ESC) 3.5
G. Military Airlift Command (MAC) 14.4
H. Strategic Air Command (SAC) 21.1
I. Tactical Air Command (TAC) 15.2
J. Air Force Combat Operations Staff (AFCOS) 0.1
K. Air Force Communications Agency (AFCA) 2.1
L. Defense Agency 0.0
M. Air Force District of Washington (AFDW) 0.3
N. Air Force Inspection Center (AFIC) 0.2
O. Air Force Intelligence Agency (AFIA) 0.2
P. Air Force Legal Services Center (AFLSC) 0.1
Q. Air Force Management Engineering Agency (AFMEA) 0.1
R. Air Force Military Personnel Center (AFMPC) 0.1
S. Air Force Morale, Welfare, and Recreation Agency (AFMWRA) 0.1
T. Air Force Office of Medical Support (AFOMS) 0.3
U. Air Force Office of Security Police (AFOSP) 1.3
V. Air Force Office of Special Investigations (AFOSI) 0.0
W. Air Force Operational Test and Evaluation Center (AFOTEC) 0.2
X. Air Force Safety Center 0.1
Y. US Air Force Academy (USAFA) 0.1
Z. Other 29.5

(USAFE 21.5)
(PACAF 8.3)

## LIST B

## DESCRIPTION OF UNIT OF ASSIGNMENT

Enter the LETTER that matches your selection on the first Column of the First Name section of your answer sheet.

A. Aircraft Maint 20.9
B. Audiovisual 0.4
C. Audit 0.1
D. Chaplain 0.3
E. Civil Engnrg 6.8
F. Communications 11.0
G. Comptroller 1.1
H. Education 0.8
I. Flying Sqn 2.8
J. Info Mgmt 2.0
K. Legal 0.1

L. Manpower 0.0
M. Medical 4.7
N. Missile Sqn 2.1
O. MWR 0.3
P. Personnel 1.4
Q. Public Affairs 0.0
R. Safety 0.2
S. Security Police 7.3
T. Services 1.5
U. Social Actions 0.1
V. Supply 7.0
W. Transportation 5.1
X. Training 0.6
.. Weather 0.2
Z. Other 22.3

## Section I - Demographics

**Please do not proceed until you have completed the section entitled "Filling In The Answer Sheet".**

**1.Your grade:**

a. E-1 Airman Basic 0.1
b. E-2 Airman 0.1
c. E-3 Airman First Class 16.9
d. E-4 Senior Airman/Sergeant 40.6
e. E-5 Staff Sergeant 39.5
f. E-6 Technical Sergeant 2.9

**2. Years on Active Duty?**

a. less than one 0.3
b. 1 to 2 years 5.5
c. 2 to 3 years 13.7
d. 3 to 4 years 10.6
e. 4 or More 69.9

**3. Are you:**

a. Female 15.6
b. Male 84.4

**4. Racial - ethnic background:**

a. Afro-American/Black 16.7
b. Caucasian/White 72.1
c. Asian or Pacific Islander 3.3
d. Hispanic (regardless of race) 6.0
e. Other 1.8

**5. What is the highest level of education you have completed?**

a. Less than high school 0.3
b. High school 29.4
c. Some college but less than 2 years 49.1
d. Two or more years of college 11.7
e. Associates degree 5.9
f. Bachelors degree 3.2
g. Advanced degree 0.4

## Section II - Methods Of Training

This section will ask you questions on methods of training used at your duty location, such as lecture, demonstrations, computer-based instruction, etc. For most of these questions focus your attention on HOW things were taught, not what was taught.

**6.Within the last 5 years (or since you entered the Air Force, if less than 5 years ago) which of the following types of training methods have you experienced at your duty location? (Mark all that apply)**

a. Classroom with an instructor. 78.0
b. OJT (on-job-training) with an instructor. 56.2
c. OJT with your supervisor. 80.7
d. OJT on your own, using reference manuals, books, and other written materials. 80.6
e. Individual training using computer-based instruction (CBI). 24.7
f. Individual training using interactive video disk (IVD). 9.2
g. Individual training using video cassette recorder (VCR). 30.3
h. Individual training using a simulator or other individual training device. 18.3
i. Correspondence courses. 33.8
j. Contractor-conducted training. 14.4

***7-16*** **Based on your most recent experience with each method listed in items 7-16, use the following responses to rate how useful that training was to your job.**

a. Very useful
b. Moderately useful
c. Moderately useless
d. Very useless
e. Did not experience this method of training or do not know

(Choose one response for each item)

**7. Classes with an instructor.**

| | |
|---|---|
| a. 40.2 | d. 2.3 |
| b. 43.2 | e. 8.7 |
| c. 5.6 | |

8. **OJT with an instructor.**

a. 41.1
b. 24.8
c. 3.3
d. 1.5
e. 29.3

9. **OJT with your supervisor.**

a. 54.7
b. 29.3
c. 5.4
d. 2.0
e. 8.5

10. **OJT on your own, using reference manuals, books, and other written materials.**

a. 39.6
b. 45.1
c. 6.4
d. 1.8
e. 7.0

11. **Individual training using computer-based instruction (CBI).**

a. 7.9
b. 16.6
c. 8.2
d. 2.7
e. 64.6

12. **Individual training using interactive video disk (IVD).**

a. 3.1
b. 7.0
c. 5.2
d. 2.6
e. 82.1

13. **Individual training using video cassette recorder (VCR).**

a. 6.2
b. 19.4
c. 10.7
d. 4.8
e. 59.0

14. **Individual training using a simulator or other individual training device.**

a. 12.9
b. 12.8
c. 3.6
d. 2.0
e. 68.7

15. **Correspondence courses.**

a. 12.2
b. 26.5
c. 10.8
d. 3.5
e. 47.0

16. **Contractor-conducted training.**

a. 8.3
b. 9.9
c. 4.2
d. 1.8
e. 75.8

***17-25*** **For each method of training listed in items 17 to 25, please use these responses to indicate whether you would prefer more or less of this method of training in the future.**

a. Prefer <u>much less</u> of this method of training.
b. Prefer <u>slightly less</u> of this method of training.
c. Present use of this method is <u>about right</u>.
d. Prefer <u>slightly more</u> of this method of training.
e. Prefer <u>much more</u> of this method of training.
f. Did not experience this method, or do not know.

**(Choose <u>one</u> response for <u>each</u> item)**

17. **Classroom with an instructor.**

a. 5.5
b. 11.5
c. 41.3
d. 17.0
e. 19.5
f. 5.3

18. **OJT with an instructor.**

a. 2.2
b. 4.6
c. 26.8
d. 23.1
e. 26.5
f. 17.0

19. **OJT with your supervisor.**

a. 2.5
b. 4.9
c. 35.2
d. 25.0
e. 27.6
f. 4.7

**20. OJT on your own, using reference manuals, books, and other written materials.**

a. 7.0
b. 12.7
c. 45.3
d. 18.0
e. 11.6
f. 5.4

**21. Individual training using computer-based instruction (CBI).**

a. 4.4
b. 5.1
c. 12.3
d. 9.4
e. 14.7
f. 53.9

**22. Individual training using interactive video disk (IVD).**

a. 3.9
b. 4.7
c. 7.1
d. 4.6
e. 11.5
f. 68.1

**23. Individual training using video cassette recorder (VCR).**

a. 6.0
b. 8.5
c. 17.4
d. 9.0
e. 10.4
f. 48.6

**24. Individual training using a simulator or other individual training device.**

a. 2.1
b. 3.7
c. 10.8
d. 10.0
e. 16.0
f. 57.3

**25. Correspondence courses.**

a. 6.0
b. 9.0
c. 27.4
d. 8.7
e. 11.2
f. 37.7

## Section III - Upgrade Training

Complete this section concerning your most recent upgrade training (UGT) to the 3, 5, or 7 skill level.

**26. What is your current skill level in your primary AFSC?**

a. Entry level 0.3
b. 3-level 5.4
c. 5-level 56.7
d. 7-level 37.5

**27. Your current Upgrade Training (UGT) status is:**

a. Currently enrolled 13.8
b. Completed within past 6 months 9.2
c. Completed more than 6 months ago 77.0

**28. For your most recent UGT, how many trainers have you been assigned to?**

a. None 18.7
b. One trainer 39.5
c. Two trainers 19.3
d. Three trainers 7.2
e. More than three trainers 15.2

**29. Upon your most recent UGT, who provided an initial evaluation to determine your training requirements? (Mark all that apply)**

a. Trainer 42.9
b. Section supervisor 43.9
c. Section training coordinator/monitor 14.3
d. Squadron OJT monitor 13.2
e. Someone other than the above 8.9
f. Did not receive an initial evaluation 13.0

**30. How are task certifications most often completed in your upgrade training? (Choose one response)**

a. Trainer/supervisor over-the-shoulder evaluation 52.9
b. Trainer/supervisor does it without performance evaluation 14.2
c. Informal (questioning concerning the tasks) 19.8
d. Outside third party evaluation (e.g., by another section/unit) 6.3
e. Outside agency evaluation (e.g., Quality Assurance) 6.7

**31. How much of your duty time during a typical week is devoted to receiving OJT?**

a. All or nearly all 4.8
b. About three-quarters 5.2
c. About half 10.4
d. About one-quarter 18.5
e. About 5 to 10 percent 39.0
f. None 22.1

**32. Is your time for OJT included in your work schedule?**

a. Yes 45.7
b. Sometimes 31.8
c. No 22.5

**33-35 For each of the statements in items 33 to 35, please use the following scale to give your own opinions about OJT.**

a. Strongly agree
b. Agree
c. Disagree
d. Strongly disagree
e. Do not know

**(Choose one response for each statement)**

**33. There is sufficient time in the work week for both your primary duties and OJT.**

a. 23.0
b. 46.5
c. 16.1
d. 12.1
e. 2.3

**34. The initial evaluation (for your current level) was an accurate assessment of your skills.**

a. 17.0
b. 57.2
c. 11.6
d. 5.9
e. 8.2

**35. Equipment and facilities needed for OJT are usually available.**

a. 14.8
b. 60.4
c. 14.7
d. 7.5
e. 2.6

## Section IV - Ancillary Training

Questions 36-47 deal with the Air Force Ancillary Training Program. The purpose of ancillary training is to provide information that contributes to the Air Force mission, but is separate from requirements that are part of the individual's primary Air Force Specialty (AFS). It does not include FTD training, Professional Military Education (PME), or any course listed in AFR 50-5 (formal schools). Some ancillary training programs are listed below with response letters.

a. Firearms Training
b. Base Supply Customer Training
c. Self-Aid and Buddy Care
d. CPR
e. Chemical Warfare Defense Training for High Threat Areas
f. Local Conditions Course
g. Uniform Code of Military Justice (UCMJ)
h. Communications Security (COMSEC)
i. Operations Security (OPSEC)

Please mark the letters of each type of ancillary training listed above that you feel applies to <u>each</u> item below. <u>(Mark all that apply)</u>

**36. Please mark the letters of each listed ancillary training that you have completed within the past 12 months.**

| | | |
|---|---|---|
| a. 54.1 | d. 43.6 | g. 18.3 |
| b. 12.2 | e. 57.3 | h. 65.2 |
| c. 63.1 | f. 19.9 | i. 62.3 |

**37. Please mark the letters of each listed ancillary training that you have completed from 1 to 2 years ago. (Including those completed within the past 12 months.)**

| | | |
|---|---|---|
| a. 63.4 | d. 52.7 | g. 34.0 |
| b. 19.1 | e. 67.3 | h. 74.3 |
| c. 75.2 | f. 33.5 | i. 72.6 |

**38. There is not enough time to conduct this type of ancillary training and still get the job done.**

| | | |
|---|---|---|
| a. 13.5 | d. 8.4 | g. 9.6 |
| b. 17.3 | e. 11.3 | h. 4.1 |
| c. 6.5 | f. 8.4 | i. 5.6 |

***39-47*** **For each of the subjects listed, in item 39-47 indicate which type of teaching materials and methods were used. Mark all methods used for each course, in your most recent attendance at each course.**

a. Lecture/presentation
b. Hands-on use of real equipment
c. Slides/overhead projectors
d. Use of simulators or mock-ups
e. Instructor demonstrated using equipment, while trainees watched
f. Computer-based instruction (CBI)
g. Interactive video disk (IVD)-(Computer and video disk)
h. Video cassette recorder (VCR)
i. I have not had this type of ancillary training

<u>(Mark all that apply for each item)</u>

**39. Firearms Training**

| | | |
|---|---|---|
| a. 67.7 | d. 14.8 | g. 0.9 |
| b. 76.7 | e. 57.3 | h. 6.4 |
| c. 16.0 | f. 0.6 | i. 17.2 |

**40. Base Supply Customer Training**

| | | |
|---|---|---|
| a. 23.9 | d. 1.6 | g. 0.6 |
| b. 5.5 | e. 3.7 | h. 1.5 |
| c. 13.3 | f. 0.4 | i. 68.6 |

**41. Self-Aid and Buddy Care**

| | | |
|---|---|---|
| a. 71.6 | d. 28.3 | g. 1.4 |
| b. 48.2 | e. 43.8 | h. 31.7 |
| c. 43.7 | f. 0.4 | i. 10.3 |

**42. CPR**

| | | |
|---|---|---|
| a. 54.6 | d. 35.4 | g. 0.9 |
| b. 41.1 | e. 41.5 | h. 26.9 |
| c. 24.2 | f. 0.4 | i. 32.7 |

**43. Chemical Warfare Defense Training for High Threat Areas**

| | | |
|---|---|---|
| a. 69.0 | d. 28.4 | g. 0.9 |
| b. 64.5 | e. 48.6 | h. 25.6 |
| c. 36.6 | f. 0.7 | i. 18.3 |

**44. Local Conditions Course**

| | | |
|---|---|---|
| a. 37.1 | d. 2.1 | g. 0.4 |
| b. 4.6 | e. 2.9 | h. 9.2 |
| c. 19.4 | f. 0.1 | i. 52.6 |

**45. Uniform Code of Military Justice (UCMJ)**

| | | |
|---|---|---|
| a. 48.1 | d. 0.9 | g. 0.2 |
| b. 2.5 | e. 1.3 | h. 9.1 |
| c. 14.3 | f. 0.4 | i. 43.1 |

**46. Communications Security (COMSEC)**

| | | |
|---|---|---|
| a. 68.3 | d. 1.3 | g. 1.6 |
| b. 4.2 | e. 2.0 | h. 16.7 |
| c. 26.9 | f. 2.3 | i. 12.8 |

**47. Operations Security (OPSEC)**

| | | |
|---|---|---|
| a. 67.1 | d. 1.1 | g. 1.5 |
| b. 4.2 | e. 2.7 | h. 17.0 |
| c. 26.7 | f. 2.3 | i. 14.0 |

## Section V - Your Training Activities During Desert Shield/Desert Storm

We need to know more about how to plan for unit-level training during a wartime environment. Please answer this section in terms of your unit's training during the period of the conflict with Iraq, from August, 1990 to February, 1991. If you were in the Air Force during this period *answer this section whether or not you were deployed to the Middle East*. If you were not in the Air Force during this period leave this section blank.

**48. In support of the conflict with Iraq, were you:**

a. Deployed to the Middle East. 13.5
b. Deployed from CONUS to overseas, but to a location other than Middle East. 4.5
c. Deployed from overseas to CONUS. 1.2
d. Deployed within the U.S. 0.8
e. Did not deploy - stayed in the same location as before. 80.1

**49. If you deployed in support of the conflict, was this deployment with your entire unit, part of your unit, or individually?**

a. Does not apply - did not deploy. 81.6
b. Deployed individually, not with my unit. 3.1
c. Deployed with part of my unit. 12.7
d. Deployed with entire unit. 2.6

**50. During the period of the conflict (from August 1990 to February 1991) which of the following types of training activities did you participate in? (Mark all that apply)**

a. Normal OJT training. 56.3
b. Special OJT to learn how to operate/maintain equipment in the desert environment. 9.1
c. Special unit training to learn how to live in the desert environment. 7.3
d. Additional ancillary training for threats such as chemical/biological warfare. 24.9
e. Training for working and living within an Arabic culture. 6.9
f. Normally scheduled ancillary training. 45.9
g. Other. 17.7

**51. During the period of conflict, that part of your duty time devoted to training:**

a. Increased substantially 7.4
b. Increased slightly 18.6
c. Did not change 52.6
d. Decreased slightly 8.5
e. Decreased substantially 12.9

**52. How well trained were you for your duties during Desert Storm? (i.e., were you trained on the right things?)**

a. Very well trained 48.3
b. Somewhat well trained 29.9
c. Little useful training 10.5
d. No useful training 11.3

*Thank you* for completing this survey. Please return this survey form and your answer sheet to the person who gave them to you.

# Appendix C

# Interview Guides, Phase II

# Appendix C-1

## Training Manager Interview Guide

**AIR FORCE SQUADRON LEVEL TRAINING PROJECT**

**INDIVIDUAL INTERVIEW**

**TRAINING MANAGERS**

## INTRODUCTION

Good morning (afternoon), Sergeant (Airman) _______________.
I am _____________ _______________, a consultant with HAY Systems, Inc., a Washington, DC-based management consultant firm. You have been selected by the Air Force to take part in a survey covering various aspects of training in the Air Force. HAY Systems is performing this survey under contract to the Technical Training Research Division, Human Resources Directorate of the Armstrong Laboratory at Brooks Air Force Base, Texas.

I am going to be asking you a few questions concerning your experience with training in the Air Force. The information you will be providing us will be used for research on training at the unit level in the Air Force. Your assistance will help us better understand the viewpoint of those involved in base level training and the on-site training process.

The information you provide will be kept in strictest confidence, and in no way attributed to you personally. The background information that you will be asked to provide will only be used to help assure that, overall, the people being interviewed are representative of the total population in the Air Force.

Please feel free to stop me if I ask a question that is not clear or you want repeated. Since this same interview is being conducted with a large number of people, some of the questions may not apply to you or your situation. Do not hesitate to say that you do not know if that is the case. The interview should take less than an hour of your time.

Do you have any questions?

1. <u>BACKGROUND</u> The first few questions concern your background:

1.1 To what type unit are you assigned? (e.g., Maintenance, Security Police, Personnel, Civil Engineering, Supply, Transportation)____________________________

1.2 What is your unit's parent Major Command? (e.g., TAC, SAC, MAC, AFMPC, AFCA)____________________

1.3 What is your current duty AFSC?________________

[If a 75XXX:]

1.3.1 What AFSC did you hold immediately prior to crossing into the 75-career field?________

1.3.2 How long have you been a 75XXX?__________

1.4 How long have you been in the Air Force?__________

1.5 For which unit(s) do you serve as training manager?________________

________________________________________

________________________________________

________________________________________

1.6 Is training management:

1.6.1 Your primary duty?_______

1.6.2 An additional duty?______

1.7 For how long have you served in this capacity?________

1.8 Were you serving in a Training Manager position prior to the 18 July 1990 change to AFR 50-23 (Enlisted Specialty Training)?

1.8.1 No_____ **(Go to next <u>section</u>.)**

1.8.2 Yes_____

1.9 Has your role as Training Manager changed significantly since publication of the 18 July 1990 AFR 50-23?

1.9.1 No_____ **(Go to next section.)**

1.9.2 Yes_____ In the following way(s):

1.9.2.1 I have less control over the unit's training program_____

1.9.2.2 I no longer have the regulatory "hammer" to enforce training procedures_____

1.9.2.3 My role as a Training Manager has been significantly diminished_____

1.9.2.4 My role as a Training Manager has been significantly enhanced or expanded______

1.9.2.5 I have more flexibility to tailor the unit's training program to local needs___

1.9.2.6 Other (specify)________________________________________

________________________________________

________________________________________

## 2. TRAINING NEEDS

2.1 Can you predict when there will be greater or lesser training needs in your unit?

2.1.1 No_____ **(Go to question 2.4)**

2.1.2 Yes_____

2.2 How far ahead can you predict?________________________________________

2.3 What helps you to predict?________________________________________

________________________________________

2.4 During the past year, have your unit level training requirements:

2.4.1 Increased_____

2.4.2 Decreased_____

2.4.3 Remained about the same_____ **(Go to question 2.6)**

2.5 What has driven the change in training requirements?

2.5.1 Influx of entry-level personnel (new enlistees or cross-trainees)_____

2.5.2 New equipment_____

2.5.3 Increased manning_____

2.5.4 Decreased manning_____

3.5.5 Decreased number of Trainers_____

3.5.6 Increased number of Trainers_____

2.5.7 Increased mission requirements_____

2.5.8 Decreased mission requirements_____

2.5.9 Revised training standards_____

2.5.10 Change in command emphasis on training_____

2.5.11 AFSC mergers/consolidations_____

2.5.12 Other (specify)_____ ________________________________________
________________________________________________________

2.6 Have there been any AFSC mergers or skill consolidations within your unit?

2.6.1 Yes_____

2.6.1.1 How have these mergers or consolidations affected unit level training requirements?________________________________

2.6.2 No_____

2.6.2.1 If AFSC mergers or consolidations were directed within your unit, what changes do you expect would result in the unit's training requirements?________________________________

2.7 Has there been an introduction of new technologies or equipment in your unit which required an increase in unit level skill or task qualification training?

2.7.1 No_____ **(Go to next <u>section</u>.)**

2.7.2 Yes_____

2.7.2.1 What training methods or technologies were required to support this unit level skill or qualification training?________________________________

## 3. SCHEDULING

3.1 Are you involved in scheduling training activities?

3.1.1 No_____ **(Go to next section.)**

3.1.2 Yes_____

3.2 How is this scheduling accomplished?

3.2.1 Manually **(Go to question 3.3)**

3.2.2 Automated scheduling system_____

3.2.2.1 What is the name of the automated scheduling system used?_______________

3.2.2.2 Where was the system developed?

3.2.2.2.1 Locally_____

3.2.2.2.2 Elsewhere (specify where)_______________

3.2.2.3 What are its good points or advantages?

3.2.2.3.1 Speed_____

3.2.2.3.2 Accuracy_____

3.2.2.3.3 Easily changed_____

3.2.2.3.4 More efficient than manual system___

3.2.2.3.5 Other (specify)___ _______________

_______________

3.2.2.3.6 None_____

3.2.2.4 What are its drawbacks or disadvantages?

3.2.2.4.1 Too complex_____

3.2.2.4.2 Too cumbersome_____

3.2.2.4.3 Too costly_____

3.2.2.4.4 Too inflexible_____

3.2.2.4.5 Other (specify)_____ _______________

3.2.2.4.6 None_____

3.3 What are the most significant problems you have with scheduling?

3.3.1 Unit mission demands_____

3.3.2 Availability of Trainers or Trainees_____

3.3.3 Last-minute changes_____

3.3.4 Lack of communication from supervisors or trainers_____

3.3.5 Lack of an automated scheduling system_____

3.3.6 Other (specify)_____ ________________________________________
________________________________________________

3.3.7 None_____

## 4. TRAINING METHODS/TECHNOLOGIES

4.1 In a training program, a number of methods and tools can be used, such as overhead projectors, sound-on-slide, videos, computers, etc. I am going to read you a list of some of these. Please tell me which ones are used for training in your unit.

4.1.1 Computer based training (CBT)_____

4.1.2 Interactive video disks (IVD)_____

4.1.3 Videotapes_____

4.1.4 Formal instructor-conducted classroom instruction_____

4.1.5 Self-study books or other printed materials_____

4.1.6 Simulators or mock-ups_____

4.1.7 Operational mission equipment_____

4.1.8 Non-operational mission equipment_____

4.2 What are the advantages of the methods used in your unit?

4.2.1 Saves money_____

4.2.2 Saves time_____

4.2.3 Requires less Instructor time_____

4.2.4 Provides real-time feedback_____

4.2.5 Allows for hands-on training_____

4.2.6 Less disruptive to operational activities_____

4.2.7 Provides realism_____

4.2.8 Other (specify)_____ ____________________________________________

4.2.9 None_____

4.3 What are the disadvantages of the methods used in your unit?

4.3.1 Costs too much money_____

4.3.2 Costs or wastes time_____

4.3.3 Requires more Instructor time_____

4.3.4 Does not provide real-time feedback_____

4.3.5 Does not allow for hands-on training_____

4.3.6 Too disruptive to operational activities_____

4.3.7 Does not provide realism_____

4.3.8 Other (specify)_____ ______________________________

4.3.9 None_____

4.4 Have any training methods been used in the past that are no longer used?

4.4.1 No_____ **(Go to next <u>section</u>.)**

4.4.2 Yes_____

4.5 Why were these methods dropped?

4.5.1 Replaced by better methods_____

4.5.2 Too expensive_____

4.5.3 Wasted too much time_____

4.5.4 Designed for equipment which became obsolete, or left the inventory_____

4.5.5 Other (specify)_____ ______________________________

______________________________

5. <u>TRAINING DEVELOPMENT</u>

5.1 Are any aspects of your unit training developed locally (mock-ups, training equipment, exercises, courses and/or course materials)?

5.1.1 No_____ **(Go to <u>question 5.3</u>)**

5.1.2 Yes_____

5.2 About how much training development is done locally versus being developed by outside sources?

5.2.1 Over 50 percent_____

5.2.2 25-50 percent_____

5.2.3 10-25 percent_____

5.2.4 Less than 10 percent_____

5.3 Do you now, or have you ever, participated in training development?

5.3.1 No_____ **(Go to next <u>section</u>.)**

5.3.2 Yes_____

5.4 What technologies have you used to develop training?

5.4.1 Instructional System Development (ISD)_____

5.4.2 Automated system (specify)_____

5.4.3 Other (specify)_____ ______________________________

______________________________

5.5 If ISD was not used, why not?

5.5.1 Not applicable. Used ISD_____

5.5.2 Not familiar with it_____

5.5.3 Too complex_____

5.5.4 Too cumbersome_____

5.5.5 Not applicable to the type training development I was doing_____

5.5.6 Too time-consuming_____

5.5.7 Too costly_____

5.5.8 Other (specify)_____ ____________________________________

5.6 What guidance do you receive or use for the development of training content?______________________________________________
______________________________________________

5.6.1 What or who is the source of this guidance?______________________________________

6. <u>DOCUMENTATION</u>

6.1 Do you document training accomplished?

6.1.1 No_____ **(Go to next <u>section</u>.)**

6.1.2 Yes_____ It is done:

6.1.2.1 Manually_____

6.1.2.2 Using an automated system_____

6.1.2.2.1 System was locally developed_____

6.1.2.2.2 System was developed elsewhere (specify where)_____ ______________________________

6.2 What are the most significant problems you have with documentation?

6.2.1 It is paperwork-intensive_____

6.2.2 It takes too much time_____

6.2.3 It is too cumbersome_____

6.2.4 It isn't standardized across bases_____

6.2.5 I question its value as currently structured_____

6.2.6 It should be automated_____

6.2.7 Other (specify)_____ ______________________________

6.2.8 None. I have no problems with it_____

7. <u>TRAINING EVALUATION</u>

7.1 Do you personally evaluate the results of training?

7.1.1 No_____

7.1.2 Yes_____

7.2 What methods are used for training evaluation in your unit?

7.2.1 Observe trainee performance (over-the-shoulder)_____

7.2.2 Verbally question trainees about job performance_____

7.2.3 Interview supervisors/trainers of trainees____

7.2.4 Written examinations_____

7.2.5 Other (specify)_____

7.2.6 Do not know_____

7.3 Are any automated systems used or available for performing evaluations?

7.3.1 No_____ **(Go to next <u>section</u>.)**

7.3.2 Yes_____

7.3.2.1 What are they?________________________________

7.3.2.2 Were they:

7.3.2.2.1 Locally developed?_____

7.3.2.2.2 Developed elsewhere? (specify)_____

________________________________________________

## 8. NETWORKING/ORGANIZATION OF TRAINING MANAGERS

8.1 Do you have contacts with other training managers at this base?

8.1.1 No_____

8.1.1.1 Why not?________________________________
**(Go to next section.)**

8.1.2 Yes_____

8.2 What types of contact do you have?

8.2.1 Informal, as-required_____

8.2.2 Formal, as-required_____

8.2.3 Formal, on a regularly scheduled basis_____

8.2.3.1 How frequently?_____

8.3 Are these contacts useful to you as a training manager?

8.3.1 No_____

8.3.1.1 Why not?________________________________
________________________________________________

8.3.2 Yes_____

8.3.2.1 In what way?

8.3.2.1.1 We share information about various training technologies_____

8.3.2.1.2 We learn from one another_____

8.3.2.1.3 We are able to solve common problems_____

8.3.2.1.4 We coordinate such things as scheduling of shared facilities_____

8.3.2.1.5 Other (specify)_____

## 9. IMPACT OF EXPANDED SQUADRON LEVEL TRAINING

9.1 Do you believe that increased levels of training can be accomplished by your unit without having a negative impact on operational capability?

9.1.1 Yes_____

9.1.1.1 By how much? (Percentage increase)_____

9.1.2 No_____

9.2 If the Air Force reduced ATC resident training, and shifted this training to the unit level, what do you believe would be the impact?

9.2.1 Unit mission would suffer - readiness would be degraded_____

9.2.2 We would need more manpower_____

9.2.3 Quality of training would suffer_____

9.2.4 We would need to find new ways of doing business_____

9.2.5 We would need to find new ways to perform the training mission_____

9.2.6 Quality of training would improve_____

9.2.7 Unit would benefit because we could tailor the training program to our specific needs_____

9.2.8 It would cause us to seek state-of-the-art training technologies such as enhanced methods and tools_____

9.2.9 Other (specify)_____ ________________________________________

________________________________________________________

10. OPINIONS ABOUT TRAINING

10.1 In your opinion, what works well in your unit training program or activities?______________________________________

10.2 What problems are there?______________________________________

10.3 Are there any training technologies that are not available to you that would benefit your training program or activities?

10.3.1 I don't know of any_____

10.3.2 Yes_____

10.3.2.1 What are they?______________________________________

10.4 Do you have any suggestions for improving unit level training?

10.4.1 No_____

10.4.2 Yes_____ ______________________________________

11. PARTICIPATION IN DESERT SHIELD/DESERT STORM

11.1 Did you participate in Desert Shield and/or Desert Storm (conflict with Iraq, August 1990 to February 1991)?

11.1.1 Yes_____ **(Go to DS Interview Form.)**

11.1.2 No_____ **THANK THE RESPONDENT**

# Appendix C-2

# Trainer Interview Guide

**AIR FORCE SQUADRON LEVEL TRAINING PROJECT**

**INDIVIDUAL INTERVIEW**

**TRAINERS**

INTRODUCTION

Good morning (afternoon), Sergeant (Airman) ________________.
I am ________________ ___________________, a consultant with HAY Systems, Inc., a Washington, DC-based management consultant firm. You have been selected by the Air Force to take part in a survey covering various aspects of training in the Air Force. HAY Systems is performing this survey under contract to the Technical Training Research Division, Human Resources Directorate of the Armstrong Laboratory at Brooks Air Force Base, Texas.

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The information you provide will be kept in strictest confidence, and in no way attributed to you personally. The background information that you will be asked to provide will only be used to help assure that, overall, the people being interviewed are representative of the total population in the Air Force.

Please feel free to stop me if I ask a question that is not clear or you want repeated. Since this same interview is being conducted with a large number of people, some of the questions may not apply to you or your situation. Do not hesitate to say that you do not know if that is the case. The interview should take less than an hour of your time.

Do you have any questions?

1. <u>BACKGROUND</u> The first few questions concern your background:

1.1 To what type unit are you assigned? (e.g., Maintenance, Security Police, Personnel, Civil Engineering, Supply, Transportation)______________________________

1.2 What is your unit's parent Major Command? (e.g., TAC, SAC, MAC, AFMPC, AFCA)________________________

1.3 What is your current duty AFSC?__________________

[If a 75XXX:]

1.3.1 What AFSC did you hold immediately prior to crossing into the 75- career field?________

1.3.2 How long have you been a 75XXX?____________

1.4 How long have you been in the Air Force?____________

1.5 For which unit(s) do you serve as trainer?

__________________________________________________

____________________________________

1.6 Is training:

1.6.1 Your primary duty?______

1.6.2 An additional duty?______

1.7 For how long have you served in this capacity?________

1.8 For what type of training are you currently a trainer?

1.8.1 On-the-Job Training (OJT)____

1.8.2 Upgrade Training (UGT)____

1.8.3 Ancillary Training____

1.8.4 Professional Military Education (PME)____

1.8.5 Field Training Detachment (FTD)____

1.8.6 Other (specify)____ __________________

1.9 During the course of your career to this point in time, how often have you been assigned trainer duties?______

1.10 How were you selected as a Trainer this time?

1.10.1 Rank_____

1.10.2 Demonstrated job-related skills_____

1.10.3 Demonstrated teaching ability_____

1.10.4 Past experience as a Trainer_____

1.10.5 Had completed Trainer training_____

1.10.6 No one else available_____

1.10.7 I volunteered_____

1.10.8 Other (specify)_____ ________________________

1.11 How were you selected as a Trainer in the past?

1.11.1 Rank_____

1.11.2 Demonstrated job-related skills_____

1.11.3 Demonstrated teaching ability_____

1.11.4 Past experience as a Trainer_____

1.11.5 Had completed Trainer training_____

1.11.6 No one else available_____

1.11.7 I volunteered_____

1.11.8 Other (specify)_____ ________________________

1.11.9 Not applicable. I have never been a Trainer in the past_____

1.12 Are you Instructor-qualified?

1.12.1 Yes_____

1.12.2 No_____

1.13 What type of training or preparation have you had to perform as a Trainer?

1.13.1 Academic Instructor Course (AIC)_____

1.13.2 OJT Supervisor Course_____

1.13.3 Other formal Trainer/Instructor Course (specify)_____
_________________________________

1.13.4 OJT with another Trainer_____

1.13.5 Self-study_____

1.13.6 Other (specify)_____ __________________________

1.13.7 None_____

1.14 Who evaluates your performance as a trainer?

1.14.1 Immediate supervisor_____

1.14.2 Unit commander_____

1.14.3 Headquarters Squadron Section Commander_____

1.14.4 First Sergeant_____

1.14.5 Unit Training Manager_____

1.14.6 Other (specify)_____ __________________________

1.15 On what basis is your performance as a Trainer evaluated?

1.15.1 Qualifications/success of Trainee(s)_____

1.15.2 Quality of the product_____

1.15.3 My demonstrated training abilities_____

1.15.4 My paperwork/documentation is up-to-date_____

1.15.5 Other (specify)_____ __________________________

1.15.6 Not evaluated as a Trainer, or Don't know_____

1.16 What portion of your normal duty week do you estimate you spend on unit level training?_____(%)

1.17 Were you serving in a Trainer position prior to the 18 July 1990 change to AFR 50-23 (Enlisted Specialty Training)?

1.17.1 No_____ **(Go to next __section__.)**

1.17.2 Yes_____

1.18 Has your role as a Trainer changed significantly since publication of the 18 July 1990 AFR 50-23?

1.18.1 No_____ **(Go to next __section__.)**

1.18.2 Yes_____ In the following way(s):

1.18.2.1 I have less control over my training program_____

1.18.2.2 I no longer have the regulatory "hammer" to enforce training procedures_____

1.18.2.3 My role as a Trainer has been significantly diminished_____

1.18.2.4 My role as a Trainer has been significantly enhanced or expanded_____

1.18.2.5 I have more flexibility to tailor my training program to local needs___

1.18.2.6 Other (specify)_____

____________________________________________________________

____________________________________________

2. <u>PLANNING</u>

2.1 Are you involved in planning training for your unit?

2.1.1 No_____ **(Go to next <u>section</u>.)**

2.1.2 Yes_____

2.2 What would you describe as realistic long-range planning for your unit's program?

2.2.1 Six months or less_____

2.2.2 One year_____

2.2.3 Eighteen months_____

2.2.4 Two years or more_____

2.3 Do you have a formal training process or Training Plan?

2.3.1 No_____ **(Go to next <u>section</u>.)**

2.3.2 Yes_____

2.3.2.1 Is your planning process automated, or is it done manually?

2.3.2.1.1 Automated_____

2.3.2.1.2 Manual_____

2.3.2.2 What factors are considered in planning training?

_____________________________________________

_____________________________________________

_____________________________________________

_____________________________________________

_____________________________________________

__________

2.3.2.3 How often is your plan updated?

2.3.2.3.1 Continuously_____

2.3.2.3.2 Monthly_____

2.3.2.3.3 Quarterly_____

2.3.2.3.4 Biannually_____

2.3.2.3.5 Annually_____

2.3.2.3.6 Other (Specify)____ ______________

2.3.2.4 Once your plan is established, does it usually require significant update or change?

2.3.2.4.1 No_____

2.3.2.4.2 Yes_____

2.3.2.5 What types of adjustments, if any, are usually required?

______________________________________________________________________
______________________________________________________________________
______________________________________________________________________
______________________________

3. <u>TRAINING NEEDS</u>

3.1 Can you predict when there will be greater or lesser training needs?

3.1.1 No_____ (Go to <u>question 3.4</u>)

3.1.2 Yes_____

3.2 How far ahead can you predict?_____________________________

3.3 What helps you to predict?_________________________________
_______________________________________________

3.4 During the past year, have your training requirements:

3.4.1 Increased_____

3.4.2 Decreased_____

3.4.3 Remained about the same_____ (Go to <u>question 3.6</u>)

3.5 What has driven the change in training requirements?

3.5.1 Influx of entry-level personnel (new enlistees or cross-trainees)_____

3.5.2 New equipment_____

3.5.3 Increased manning_____

3.5.4 Decreased manning_____

3.5.5 Decreased number of Trainers_____

3.5.6 Increased number of Trainers_____

3.5.7 Increased mission requirements_____

3.5.8 Decreased mission requirements_____

3.5.9 Revised training standards_____

3.5.10 Change in command emphasis on training_____

3.5.11 AFSC mergers/consolidations_____

3.5.12 Other (specify)_____ ______________________________
_______________________________________________

3.6 Have there been any AFSC mergers or skill consolidations within your unit?

3.6.1 Yes_____

3.6.1.1 How have these mergers or consolidations affected your training requirements?

______________________________________

______________________________________

3.6.2 No_____

3.6.2.1 If AFSC mergers or consolidations were directed within your unit, what changes do you expect would result in your training requirements?______________________

______________________________________

______________________________________

3.7 Has there been an introduction of new technologies or equipment in your unit which required an increase in unit level skill or task qualification training?

3.7.1 No_____ **(Go to next <u>section</u>.)**

3.7.2 Yes_____

3.7.2.1 What training methods or technologies were required to support this unit level skill or qualification training?______________________________

______________________________________

______________________________________

## 4. SCHEDULING

4.1 Are you involved in scheduling training activities?

4.1.1 No_____ **(Go to next section.)**

4.1.2 Yes_____

4.2 How is this scheduling accomplished?

4.2.1 Manually **(Go to question 4.3)**

4.2.2 Automated scheduling system_____

4.2.2.1 Where was the system developed?

4.2.2.1.1 Locally_____

4.2.2.1.2 Elsewhere (specify where)___________

4.2.2.2 What are its good points or advantages?

4.2.2.2.1 Speed_____

4.2.2.2.2 Accuracy_____

4.2.2.2.3 Easily changed_____

4.2.2.2.4 More efficient than manual system___

4.2.2.2.5 Other (specify)___ ________________

_____________________________________

4.2.2.2.6 None_____

4.2.2.3 What are its drawbacks or disadvantages?

4.2.2.3.1 Too complex_____

4.2.2.3.2 Too cumbersome_____

4.2.2.3.3 Too costly_____

4.2.2.3.4 Too inflexible_____

4.2.2.3.5 Other (specify)_____ _____________

____________________________________

4.2.2.3.6 None_____

4.3 What are the most significant problems you have with scheduling?

4.3.1 Unit mission demands_____

4.3.2 Availability of Trainers or Trainees_____

4.3.3 Last-minute changes_____

4.3.4 Lack of communication from supervisors_____

4.3.5 Lack of an automated scheduling system_____

4.3.6 Other (specify)_____ ______________________________
__________________________________________________

4.3.7 None_____

5. <u>TRAINING METHODS/TECHNOLOGIES</u>

5.1 In a training program, a number of methods and tools can be used, such as overhead projectors, sound-on-slide, videos, computers, etc. I am going to read you a list of some of these. Please tell me which ones are used for training in your unit.

5.1.1 Computer based training (CBT)_____

5.1.2 Interactive video disks (IVD)_____

5.1.3 Videotapes_____

5.1.4 Formal instructor-conducted classroom instruction_____

5.1.5 Self-study books or other printed materials_____

5.1.6 Simulators or mock-ups_____

5.1.7 Operational mission equipment_____

5.1.8 Non-operational mission equipment_____

5.2 What are the advantages of the methods used in your unit?

5.2.1 Saves money_____

5.2.2 Saves time_____

5.2.3 Requires less Instructor time_____

5.2.4 Provides real-time feedback_____

5.2.5 Allows for hands-on training_____

5.2.6 Less disruptive to operational activities_____

5.2.7 Provides realism_____

5.2.8 Other (specify)_____ ______________________________

5.2.9 None_____

5.3 What are the disadvantages of the methods used in your unit?

5.3.1 Costs too much money_____

5.3.2 Wastes time_____

5.3.3 Requires more Instructor time_____

5.3.4 Does not provide real-time feedback_____

5.3.5 Does not allow for hands-on training_____

5.3.6 Too disruptive to operational activities_____

5.3.7 Does not provide realism_____

5.3.8 Other (specify)_____ ________________________

5.3.9 None_____

5.4 Have any training methods been used in the past that are no longer used?

5.4.1 No_____ **(Go to next <u>section</u>.)**

5.4.2 Yes_____

5.5 Why were these methods dropped?

5.5.1 Replaced by better methods_____

5.5.2 Too expensive_____

5.5.3 Wasted too much time_____

5.5.4 Designed for equipment which became obsolete, or left the inventory_____

5.5.5 Other (specify)_____ ________________________
________________________________________

6. <u>TRAINING DEVELOPMENT</u>

6.1 Are any aspects of your unit training developed locally (mock-ups, training equipment, exercises, courses and/or course materials)?

6.1.1 No_____ **(Go to <u>question 6.3</u>)**

6.1.2 Yes_____

6.2 About how much training development is done locally versus being developed by outside sources?

6.2.1 Over 50 percent_____

6.2.2 25-50 percent_____

6.2.3 10-25 percent_____

6.2.4 Less than 10 percent_____

6.3 Do you now, or have you ever, participated in training development?

6.3.1 No_____ **(Go to next <u>section</u>.)**

6.3.2 Yes_____

6.4 What technologies have you used to develop training?

6.4.1 Instructional System Development (ISD)_____

6.4.2 Automated system (specify)_____

6.4.3 Other (specify)_____ ______________________________

____________________________________________

6.5 If ISD was not used, why not?

6.5.1 Not applicable. Used ISD_____

6.5.2 Not familiar with it_____

6.5.3 Too complex_____

6.5.4 Too cumbersome_____

6.5.5 Not applicable to the type training development I was doing_____

6.5.6 Too time-consuming_____

6.5.7 Too costly_____

6.5.8 Other (specify)_____ ______________

6.6 What guidance do you receive or use for the development of training content?____________________________________
________________________________________________________

6.6.1 What or who is the source of this guidance?________________________________

## 7. DOCUMENTATION

7.1 Do you document training accomplished?

7.1.1 No_____ **(Go to next section.)**

7.1.2 Yes_____

7.2 How is your training documentation accomplished?

7.2.1 Manually_____

7.2.2 Using an automated system_____

7.2.2.1 What is the name of the automated system?
_______________________________________

7.2.2.2 Where was the system developed?

7.2.2.2.1 Locally_____

7.2.2.2.2 Elsewhere (specify where)___________
_______________________________________

7.3 What are the most significant problems you have with documentation?

7.3.1 It is paperwork-intensive_____

7.3.2 It takes too much time_____

7.3.3 It is too cumbersome_____

7.3.4 It isn't standardized across bases_____

7.3.5 I question its value as currently structured_____

7.3.6 It should be automated_____

7.3.7 Other (specify)_____ _______________________

7.3.8 None. I have no problems with it_____

8. TRAINING EVALUATION

8.1 Do you personally evaluate the results of training?

8.1.1 No_____ **(Go to next section.)**

8.1.2 Yes_____

8.2 What methods do you use for training evaluation?

8.2.1 Observe trainee performance (over-the-shoulder)_____

8.2.2 Verbally question trainees about job performance_____

8.2.3 Interview supervisors of trainees____

8.2.4 Written examinations_____

8.2.5 Other (specify)_____

8.3 Are any automated systems used or available for performing evaluations?

8.3.1 No_____ **(Go to next section.)**

8.3.2 Yes_____

8.3.2.1 What are they?______________________________

8.3.2.2 Were they:

8.3.2.2.1 Locally developed?_____

8.3.2.2.2 Developed elsewhere? (specify)_____
________________________________________

## 9. INTERACTION WITH TRAINING MANAGER

9.1 About how often do you have contact with your unit Training Manager?______________________________

9.2 What types of contact do you have?

9.2.1 Informal, as-required_____

9.2.2 Formal, as-required_____

9.2.3 Formal, on a regularly scheduled basis_____

9.2.3.1 How frequently?_____

9.3 Are these contacts useful to you as a trainer?

9.3.1 No_____

9.3.1.1 Why not?______________________________

______________________________________________

9.3.2 Yes_____

9.3.2.1 In what way?

9.3.2.1.1 We share information about various training technologies_____

9.3.2.1.2 We learn from one another_____

9.3.2.1.3 We are able to solve common problems_____

9.3.2.1.4 We coordinate such things as scheduling of shared facilities_____

9.3.2.1.5 He/she helps me with "problem trainees"_____

9.3.2.1.6 Other (specify)_____

10. IMPACT OF EXPANDED SQUADRON LEVEL TRAINING

10.1 Do you believe that increased levels of training can be accomplished by your unit without having a negative impact on operational capability?

10.1.1 Yes_____

10.1.1.1 By how much? (Percentage increase)_____

10.1.2 No_____

10.2 If the Air Force reduced ATC resident training, and shifted this training to the unit level, what do you believe would be the impact?

10.2.1 Unit mission would suffer - readiness would be degraded_____

10.2.2 We would need more manpower_____

10.2.3 Quality of training would suffer_____

10.2.4 We would need to find new ways of doing business_____

10.2.5 We would need to find new ways to perform the training mission_____

10.2.6 Quality of training would improve_____

10.2.7 Unit would benefit because we could tailor the training program to our specific needs_____

10.2.8 It would cause us to seek state-of-the-art training technologies such as enhanced methods and tools_____

10.2.9 Other (specify)_____ ________________________

________________________________________

11. OPINIONS ABOUT TRAINING

11.1 In your opinion, what works well in your unit training program or activities?________________________________
________________________________________________________
________________________________________________________
________________________________________________________

11.2 What problems are there?______________________________
________________________________________________________
________________________________________________________
________________________________________________________

11.3 Are there any training technologies that are not available to you that would benefit your training program or activities?

11.3.1 I don't know of any_____

11.3.2 Yes_____

11.3.2.1 What are they?__________________________
________________________________________
________________________________________

11.4 Do you have any suggestions for improving unit level training?

11.4.1 No_____

11.4.2 Yes_____ ________________________________
________________________________________________________
________________________________________________________
________________________________________________________
________________________________________________________
________________________________________________________
________________________________________________________
________________________________________________________

12. PARTICIPATION IN DESERT SHIELD/DESERT STORM

12.1 Did you participate in Desert Shield and/or Desert Storm (conflict with Iraq, August 1990 to February 1991)?

12.1.1 Yes_____ **(Go to DS Interview Form.)**

12.1.2 No_____ **THANK THE RESPONDENT**

# Appendix C-3

# Trainee Interview Guide

# AIR FORCE SQUADRON LEVEL TRAINING PROJECT

## INDIVIDUAL INTERVIEW

## TRAINEES

INTRODUCTION

Good morning (afternoon), Sergeant (Airman) ______________.
I am ____________ ______________, a consultant with HAY Systems, Inc., a Washington, DC-based management consultant firm. You have been selected by the Air Force to take part in a survey covering various aspects of training in the Air Force. HAY Systems is performing this survey under contract to the Technical Training Research Division, Human Resources Directorate of the Armstrong Laboratory at Brooks Air Force Base, Texas.

I am going to be asking you a few questions concerning your experience with training in the Air Force. The information you will be providing us will be used for research on training at the unit level in the Air Force. Your assistance will help us better understand the viewpoint of those involved in base level training and the on-site training process.

The information you provide will be kept in strictest confidence, and in no way attributed to you personally. The background information that you will be asked to provide will only be used to help assure that, overall, the people being interviewed are representative of the total population in the Air Force.

Please feel free to stop me if I ask a question that is not clear or you want repeated. Since this same interview is being conducted with a large number of people, some of the questions may not apply to you or your situation. Do not hesitate to say that you do not know if that is the case. The interview should take less than an hour of your time.

Do you have any questions?

1. BACKGROUND The first few questions concern your background:

1.1 To what type unit are you assigned? (e.g., Maintenance, Security Police, Personnel, Civil Engineering, Supply, Transportation)______________________________

1.2 What is your unit's parent Major Command? (e.g., TAC, SAC, MAC, AFMPC, AFCA)_________________________

1.3 What is your duty AFSC?__________

1.4 How long have you been in the Air Force?___________

1.5 Are you currently taking part in any kind of training?

1.5.1 Yes____ It is of the following type:

1.5.1.1 On-the-Job (OJT) Upgrade Training____

1.5.1.2 Field Training Detachment (FTD)____

1.5.1.3 Studying CDCs____

1.5.1.4 Ancillary Training____

1.5.1.5 Professional Military Education (PME)____

1.5.1.6 Other (specify)____ ______________

1.5.2 No____ What was the most recent training that you completed?

1.5.2.1 On-the-Job (OJT) Upgrade Training____

1.5.2.2 Field Training Detachment (FTD)____

1.5.2.3 Studying CDCs____

1.5.2.4 Ancillary Training____

1.5.2.5 Professional Military Education (PME)____

1.5.2.6 Other (specify)____ ______________

1.5.2.7 None____

1.6 What portion of your normal duty week is/was spent on unit level training?_____ (%)

2. OPINIONS OF TRAINING

2.1 How would you compare the training you receive in your unit to the training you received in tech school?

2.1.1 Not applicable; I didn't attend tech school___

2.1.2 Not applicable; I have received no training in the unit_____

2.1.3 Better in the unit_____

2.1.4 Better in tech school_____

2.1.5 About the same_____

2.1.6 No opinion, or have no way of judging_____

2.2 If the same course or skill qualification were being taught in your unit and at a tech school, which do you believe would better prepare you to perform your job?

2.2.1 In tech school_____ Why?

2.2.1.1 More time for concentrated/detailed training in tech school_____

2.2.1.2 Tech school provides a better teaching environment_____

2.2.1.3 Equipment is more readily available in tech school_____

2.2.1.4 My unit has no one I feel is qualified to teach what I need to know_____

2.2.1.5 Other (specify)_____ ____________________

____________________________________________

____________________________________________

2.2.2 In my unit_____ Why?

2.2.2.1 Unit level training is closer to the "real world"_____

2.2.2.2 Unit level training provides better opportunity for "hands-on" training_____

2.2.2.3 Unit level training can be tailored to actual/operational equipment or environment_____

2.2.2.4 My unit has trainers who are better qualified to teach than those at tech school_____

2.2.2.5 Other (specify)_____ ____________________

____________________________________________

2.2.3 They are both of equal quality_____

## 3. TRAINING METHODS/TECHNOLOGIES

3.1 In a training program, a number of methods and tools can be used such as overhead projectors, sound-on-slide, videos, computers, etc. I am going to read you a list of some of these. Tell me which ones are (or have been) used for training in your unit.

3.1.1 Computer based training (CBT)_____

3.1.2 Interactive video disks (IVD)_____

3.1.3 Videotapes_____

3.1.4 Formal instructor-conducted classroom instruction_____

3.1.5 Self-study books or other printed materials___

3.1.6 Simulators or mock-ups_____

3.1.7 Operational mission equipment_____

3.1.8 Non-operational mission equipment_____

3.1.9 Other (specify)_____ _________________________

3.1.10 Do not know_____ (Go to next <u>section</u>.)

3.2 Of the methods or tools that you named, which ones did you find to be <u>most</u> effective?

3.2.1 Computer based training (CBT)_____

3.2.2 Interactive video disks (IVD)_____

3.2.3 Videotapes_____

3.2.4 Formal instructor-conducted classroom instruction_____

3.2.5 Self-study books or other printed materials_____

3.2.6 Simulators or mock-ups_____

3.2.7 Operational mission equipment_____

3.2.8 Non-operational mission equipment_____

3.2.9 Other (specify)_____ ______________________

3.3 Why do you feel this (these) is (are) the most effective?______________________________________________

______________________________________________________

______________________________________________________

______________________________________________________

3.4 Which ones did you find to be <u>least</u> effective?

3.4.1 Computer based training (CBT)_____

3.4.2 Interactive video disks (IVD)_____

3.4.3 Videotapes_____

3.4.4 Formal instructor-conducted classroom instruction_____

3.4.5 Self-study books or other printed materials_____

3.4.6 Simulators or mock-ups_____

3.4.7 Operational mission equipment_____

3.4.8 Non-operational mission equipment_____

3.4.9 Other (specify)_____ ______________________

3.5 Why do you feel this (these) is (are) the least effective?______________________________________________

______________________________________________________

______________________________________________________

4. <u>TRAINING EVALUATIONS</u>

4.1 How are the results of your training evaluated?

4.1.1 Trainer observes my performance (over-the-shoulder)_____

4.1.2 Trainer verbally questions me about job performance_____

4.1.3 My supervisor is interviewed____

4.1.4 Written examinations_____

4.1.5 Other (specify)_____

4.2 Are you satisfied that this is an accurate assessment of your knowledge and skills?

4.2.1 Yes_____

4.2.2 No_____

4.2.2.1 What would be a better assessment?_______

4.2.3 Do not know_____

4.3 Are you satisfied that your training evaluations reflect your ability to perform your job tasks?

4.3.1 Yes_____

4.3.2 No_____

4.3.2.1 Why not?___________________________

5. <u>PARTICIPATION IN DESERT SHIELD/DESERT STORM</u>

5.1 Did you participate in Desert Shield and/or Desert Storm (conflict with Iraq, August 1990 to February 1991)?

5.1.1 Yes_____ **(Go to DS Interview Form.)**

5.1.2 No_____ **THANK THE RESPONDENT**

# Appendix C-4

# Desert Shield/Desert Storm Interview Guide

**AIR FORCE SQUADRON LEVEL TRAINING PROJECT**

**INDIVIDUAL INTERVIEW**

**DESERT SHIELD/DESERT STORM PARTICIPANTS**

ADMINISTRATIVE NOTE

This addendum interview is intended only for those who participated in Desert Shield and/or Desert Storm. The interview will be conducted in conjunction with, but following the primary interview.

INTRODUCTION

I would now like to continue the interview with a few additional questions which specifically focus on your participation in Desert Shield and/or Desert Storm.

Again, feel free to stop me if I ask a question that is not clear or you want repeated. If any question infringes on what you consider to be sensitive or classified information, please point that fact out.

Do you have any questions?

1. BACKGROUND

1.1 Did you deploy in support of Operation Desert Shield and/or Desert Storm?

1.1.1 No. I remained here (or at my base at the time) in a support or alert role._____ **(Go to next section.)**

1.1.2 Yes_____

1.2 To where were you deployed?

1.2.1 Forward area in the Middle East (e.g., Saudi Arabia, Oman)_____

1.2.2 Rear echelon or staging area (e.g., Europe)___

1.2.3 CONUS base_____

1.2.4 Other (specify)_____ ____________________

1.3 For how long were you deployed?____________________

1.4 What was your primary duty while deployed?____________________________________________________________

1.5 In what training capacity did you function?

1.5.1 Training Manager_____

1.5.2 Trainer_____

1.5.3 Trainee_____

1.5.4 Unit Commander_____

1.5.5 Supervisor_____

1.5.6 None_____

## 2. ASSESSMENT OF TRAINING

2.1 How well prepared were you for the duty requirements of Desert Shield/Desert Storm?

2.1.1 Well prepared_____

2.1.2 Not well prepared_____

2.1.2.1 Why not?___________________________________________

___________________________________________

___________________________________________

2.2 What skill or informational training did you receive or provide during Desert Shield/Desert Storm?

2.2.1 Normal OJT_____

2.2.2 New job-related skills/information_____

2.2.3 Living and working in foreign country_____

2.2.4 Additional ancillary training for threats such as nuclear/chemical/biological warfare_____

2.2.5 Special training to learn how to operate or maintain equipment in the desert environment__

2.2.6 Other (specify)_____ ___________________________________________

___________________________________________

2.2.7 None_____ **(THANK THE RESPONDENT AND CONCLUDE THE INTERVIEW)**

2.3 How quickly was this training provided?

2.3.1 Immediately_____

2.3.2 After some minor delay_____

2.3.3 After considerable delay_____

2.3.4 Too late to be of value_____

2.4 Who provided this training_____

2.4.1 Supervisor_____

2.4.2 Trainer_____

2.4.3 Field Training Detachment (FTD) Instructor____

2.4.4 I provided the training_____

2.4.5 Other (specify)_____ ________________________________________

2.5 What problems were encountered in conducting the training?

2.5.1 Scheduling around mission requirements_____

2.5.2 Availability of qualified instructors_____

2.5.3 Availability of up-to-date, pertinent training materials or equipment_____

2.5.4 Lack of adequate training facilities_____

2.5.5 Other (specify)_____ ________________________________________
____________________________________________________

2.5.6 None_____

2.6 The problems were:

2.6.1 Insurmountable_____

2.6.2 Not insurmountable; they just required the following innovations:_______________________________________________
________________________________________________________
________________________________________________________
________________________________________________________

2.7 "Normal" training (e.g., OJT Upgrade Training) was:

2.7.1 Continued with no or minimal interruption_____

2.7.2 Waived or ignored_____

2.7.3 Not required because we only took trained personnel_____

3. <u>TRAINING METHODS/TECHNOLOGIES</u>

3.1 What methods were used to provide the training?

3.1.1 Hands-on and over-the-shoulder instruction_____

3.1.2 Self-paced instruction using written materials, such as texts or manuals_____

3.1.3 Group study of written materials_____

3.1.4 Computer-assisted instruction (CAI)_____

3.1.5 Interactive video disks (IVD)_____

3.1.6 Video cassette recordings (VCR)_____

3.1.7 Simulators or mock-ups_____

3.1.8 Lecture/presentation_____

3.1.9 Other (specify)_____ ______________________________

3.2 Which methods worked best?

3.2.1 Hands-on and over-the-shoulder instruction_____

3.2.2 Self-paced instruction using written materials, such as texts or manuals_____

3.2.3 Group study of written materials_____

3.2.4 Computer-assisted instruction (CAI)_____

3.2.5 Interactive video disks (IVD)_____

3.2.6 Video cassette recordings (VCR)_____

3.2.7 Simulators or mock-ups_____

3.2.8 Lecture/presentation_____

3.2.9 Other (specify)_____ ______________________________

3.3 Why did they work best?________________________________________________

3.4 Which methods were tried, but did not work well?

3.4.1 Hands-on and over-the-shoulder instruction____

3.4.2 Self-paced instruction using written materials, such as texts or manuals_____

3.4.3 Group study of written materials_____

3.4.4 Computer-assisted instruction (CAI)_____

3.4.5 Interactive video disks (IVD)_____

3.4.6 Video cassette recordings (VCR)_____

3.4.7 Simulators or mock-ups_____

3.4.8 Lecture/presentation_____

3.4.9 Other (specify)_____ ______________________________

3.4.10 None_____

3.5 Why did they not work well?________________________________________________

3.6 Are you aware of any methods or technologies that could have been used to enhance training, but were not?

3.6.1 No_____

3.6.2 Yes; for example:_____

3.6.2.1 Hands-on and over-the-shoulder instruction____

3.6.2.2 Self-paced instruction using written materials, such as texts or manuals_____

3.6.2.3 Group study of written materials_____

3.6.2.4 Computer-assisted instruction (CAI)_____

3.6.2.5 Interactive video disks (IVD)_____

3.6.2.6 Video cassette recordings (VCR)_____

3.6.2.7 Simulators or mock-ups_____

3.6.2.8 Lecture/presentation_____

3.6.2.9 Other (specify)_____ ______________________________

______________________________________________

3.7 What other changes would you make in the manner in which training was conducted, and why?______________________________

______________________________________________

______________________________________________

______________________________________________

4. <u>IMPACT OF DESERT STORM/DESERT SHIELD ON TRAINING</u>

4.1 What do you consider to be the essential training lessons learned as a result of this operation?

______________________________________________________________________
______________________________________________________________________
______________________________________________________________________
______________________________________________________________________
______________________________________________________________________

4.2 If you could change anything done with regard to training during such a wartime operation, what would it be, and why?______________________________________________________________________
______________________________________________________________________
______________________________________________________________________
______________________________________________________________________
______________________________________________________________________

**THANK THE RESPONDENT**

# Appendix D

# Data Analysis Code Sheets

*(This appendix provides guidance for those who wish to review or re-analyze the data collected for the Squadron Level Training Phase II project. Through the use of these code sheets, data responses to any specific question or background information can be located in the computerized data set. Separate data bases exist for survey information collected from Training Managers, Trainers, and Trainees. This is also true for interview information which also includes a separate data base for Desert Storm/Shield related data.)*

# Appendix D-1

# Training Manager Survey Code Sheets

## STRUCTURE OF TRAINER DATA

| FLD# | Field Name | Type | NC |
|---|---|---|---|
| 1 | REC_NO | Numeric | 3 |
| 2 | CE111 | Numeric | 1 |
| 3 | MAINT112 | Numeric | 1 |
| 4 | MED113 | Numeric | 1 |
| 5 | MS114 | Numeric | 1 |
| 6 | PERS115 | Numeric | 1 |
| 7 | SP116 | Numeric | 1 |
| 8 | SUP117 | Numeric | 1 |
| 9 | TRANS118 | Numeric | 1 |
| 10 | MAC121 | Numeric | 1 |
| 11 | SAC122 | Numeric | 1 |
| 12 | TAC123 | Numeric | 1 |
| 13 | AFSC13 | Character | 7 |
| 14 | PAFSC131 | Character | 7 |
| 15 | 5XXX132 | Numeric | 4 |
| 16 | TIS14 | Numeric | 4 |
| 17 | PRI161 | Numeric | 1 |
| 18 | ADD162 | Numeric | 1 |
| 19 | MEASTR17 | Numeric | 4 |
| 20 | OJT181 | Numeric | 1 |
| 21 | UGT182 | Numeric | 1 |
| 22 | ANCIL183 | Numeric | 1 |
| 23 | PME184 | Numeric | 1 |
| 24 | FTD185 | Numeric | 1 |
| 25 | RANK1101 | Numeric | 1 |
| 26 | KILL1102 | Numeric | 1 |
| 27 | EACH1103 | Numeric | 1 |
| 28 | EXPT1104 | Numeric | 1 |
| 29 | TRTR1105 | Numeric | 1 |
| 30 | NELS1106 | Numeric | 1 |
| 31 | VOL1107 | Numeric | 1 |
| 32 | OSIT1108 | Numeric | 1 |
| 33 | EXP1109 | Numeric | 1 |
| 34 | RANK1111 | Numeric | 1 |
| 35 | KILL1112 | Numeric | 1 |
| 36 | EACH1113 | Numeric | 1 |
| 37 | EXPT1114 | Numeric | 1 |
| 38 | TRTR1115 | Numeric | 1 |
| 39 | NELS1116 | Numeric | 1 |
| 40 | VOL1117 | Numeric | 1 |
| 41 | OSIT1118 | Numeric | 1 |

| FLD# | Field Name | Type | NC |
|---|---|---|---|
| 42 | EXP1119 | Numeric | 1 |
| 43 | NA11111 | Numeric | 1 |
| 44 | YES1121 | Numeric | 1 |
| 45 | NO1122 | Numeric | 1 |
| 46 | AIC1131 | Numeric | 1 |
| 47 | TSUP1132 | Numeric | 1 |
| 48 | TTI1133 | Numeric | 1 |
| 49 | OJT1134 | Numeric | 1 |
| 50 | SELF1135 | Numeric | 1 |
| 51 | FTD1136 | Numeric | 1 |
| 52 | LEAD1137 | Numeric | 1 |
| 53 | EXP1138 | Numeric | 1 |
| 54 | ONE11310 | Numeric | 1 |
| 55 | SUPV1141 | Numeric | 1 |
| 56 | OMDR1142 | Numeric | 1 |
| 57 | HSSC1143 | Numeric | 1 |
| 58 | IRST1144 | Numeric | 1 |
| 59 | UTM1145 | Numeric | 1 |
| 60 | COIC1146 | Numeric | 1 |
| 61 | QA1147 | Numeric | 1 |
| 62 | ESUC1151 | Numeric | 1 |
| 63 | QUAL1152 | Numeric | 1 |
| 64 | DTA1153 | Numeric | 1 |
| 65 | DOX1154 | Numeric | 1 |
| 66 | NEDK1156 | Numeric | 1 |
| 67 | OH1161 | Numeric | 1 |
| 68 | ETNN1162 | Numeric | 1 |
| 69 | STSN1163 | Numeric | 1 |
| 70 | FTFN1164 | Numeric | 1 |
| 71 | TTTN1165 | Numeric | 1 |
| 72 | LTT1166 | Numeric | 1 |
| 73 | NO1171 | Numeric | 1 |
| 74 | YES1172 | Numeric | 1 |
| 75 | NO1181 | Numeric | 1 |
| 76 | YES1182 | Numeric | 1 |
| 77 | LC11821 | Numeric | 1 |
| 78 | NRH11822 | Numeric | 1 |
| 79 | DIM11823 | Numeric | 1 |
| 80 | ENH11824 | Numeric | 1 |
| 81 | LEX11825 | Numeric | 1 |
| 82 | CMS1191 | Numeric | 1 |
| 83 | SMS1192 | Numeric | 1 |
| 84 | MSG1193 | Numeric | 1 |
| 85 | TSG1194 | Numeric | 1 |
| 86 | SSG1195 | Numeric | 1 |

# VER0002X: SLT SURVEY FORM FOR TRAINING MANAGERS

| FLD# | NC | SC | EC | NAME | DESCRIPTION | RANGE | |
|---|---|---|---|---|---|---|---|
| 1 | 1 | 1 | 1 | LISTA | CODE FOR MAJ. COMMANDS | FIELD OPR. AGENCIES, ETC. | A-Z |
| 2 | 10 | 2 | 11 | FILLER | FILLER | BLANKS | |
| 3 | 1 | 12 | 12 | LISTB | CODE FOR DESCRIPTION OF UNIT OF ASSIGNMENT | | A-Z |
| 4 | 14 | 13 | 26 | FILLER | FILLER | BLANKS | |
| 5 | 9 | 27 | 35 | SSAN | SOCIAL SECURITY ACCT NUMBER | 0-9 | |
| 6 | 4 | 36 | 39 | VERSION | VERSION NUMBER | 0-9 | |
| 7 | 12 | 40 | 51 | FILLER | FILLER | BLANKS | |
| 8 | 1 | 52 | 52 | Q01 | QUESTION 1 | | A-I |
| 9 | 1 | 53 | 53 | Q02 | QUESTION 2 | | A-E |
| 10 | 1 | 54 | 54 | Q03RES01 | QUESTION 3, RESPONSE 1 | 0,1 | |
| 11 | 1 | 55 | 55 | Q03RES02 | QUESTION 3, RESPONSE 2 | 0,1 | |
| 12 | 1 | 56 | 56 | Q03RES03 | QUESTION 3, RESPONSE 3 | 0,1 | |
| 13 | 1 | 57 | 57 | Q03RES04 | QUESTION 3, RESPONSE 4 | 0,1 | |
| 14 | 1 | 58 | 58 | Q03RES05 | QUESTION 3, RESPONSE 5 | 0,1 | |
| 15 | 1 | 59 | 59 | Q03RES06 | QUESTION 3, RESPONSE 6 | 0,1 | |
| 16 | 1 | 60 | 60 | Q03RES07 | QUESTION 3, RESPONSE 7 | 0,1 | |
| 17 | 1 | 61 | 61 | Q03RES08 | QUESTION 3, RESPONSE 8 | 0,1 | |
| 18 | 1 | 62 | 62 | Q03RES09 | QUESTION 3, RESPONSE 9 | 0,1 | |
| 19 | 1 | 63 | 63 | Q03RES10 | QUESTION 3, RESPONSE 10 | 0,1 | |
| 20 | 1 | 64 | 64 | Q03RES11 | QUESTION 3, RESPONSE 11 | 0,1 | |
| 21 | 1 | 65 | 65 | Q04 | QUESTION 4 | | A-E |
| 22 | 1 | 66 | 66 | Q05 | QUESTION 5 | | A,B |
| 23 | 1 | 67 | 67 | Q06RES01 | QUESTION 6, RESPONSE 1 | 0,1 | |
| 24 | 1 | 68 | 68 | Q06RES02 | QUESTION 6, RESPONSE 2 | 0,1 | |
| 25 | 1 | 69 | 69 | Q06RES03 | QUESTION 6, RESPONSE 3 | 0,1 | |
| 26 | 1 | 70 | 70 | Q06RES04 | QUESTION 6, RESPONSE 4 | 0,1 | |
| 27 | 1 | 71 | 71 | Q06RES05 | QUESTION 6, RESPONSE 5 | 0,1 | |
| 28 | 1 | 72 | 72 | Q06RES06 | QUESTION 6, RESPONSE 6 | 0,1 | |
| 29 | 1 | 73 | 73 | Q06RES07 | QUESTION 6, RESPONSE 7 | 0,1 | |
| 30 | 1 | 74 | 74 | Q06RES08 | QUESTION 6, RESPONSE 8 | 0,1 | |
| 31 | 1 | 75 | 75 | Q06RES09 | QUESTION 6, RESPONSE 9 | 0,1 | |
| 32 | 1 | 76 | 76 | Q06RES10 | QUESTION 6, RESPONSE 10 | 0,1 | |
| 33 | 1 | 77 | 77 | Q07 | QUESTION 7 | | A-F |
| 34 | 1 | 78 | 78 | Q08RES01 | QUESTION 8, RESPONSE 1 | 0,1 | |
| 35 | 1 | 79 | 79 | Q08RES02 | QUESTION 8, RESPONSE 2 | 0,1 | |
| 36 | 1 | 80 | 80 | Q08RES03 | QUESTION 8, RESPONSE 3 | 0,1 | |
| 37 | 1 | 81 | 81 | Q08RES04 | QUESTION 8, RESPONSE 4 | 0 1 | |
| 38 | 1 | 82 | 82 | Q08RES05 | QUESTION 8, RESPONSE 5 | 0,1 | |
| 39 | 1 | 83 | 83 | Q08RES06 | QUESTION 8, RESPONSE 6 | 0,1 | |
| 40 | 1 | 84 | 84 | Q08RES07 | QUESTION 8, RESPONSE 7 | 0,1 | |
| 41 | 1 | 85 | 85 | Q08RES08 | QUESTION 8, RESPONSE 8 | 0,1 | |
| 42 | 1 | 86 | 86 | Q09 | QUESTION 9 | | A-F |
| 43 | 1 | 87 | 87 | Q10 | QUESTION 10 | | A-D |
| 44 | 1 | 88 | 88 | Q11RES01 | QUESTION 11, RESPONSE 1 | 0,1 | |
| 45 | 1 | 89 | 89 | Q11RES02 | QUESTION 11, RESPONSE 2 | 0,1 | |
| 46 | 1 | 90 | 90 | Q11RES03 | QUESTION 11, RESPONSE 3 | 0,1 | |
| 47 | 1 | 91 | 91 | Q11RES04 | QUESTION 11, RESPONSE 4 | 0,1 | |
| 48 | 1 | 92 | 92 | Q11RES05 | QUESTION 11, RESPONSE 5 | 0,1 | |
| 49 | 1 | 93 | 93 | Q11RES06 | QUESTION 11, RESPONSE 6 | 0,1 | |
| 50 | 1 | 94 | 94 | Q11RES07 | QUESTION 11, RESPONSE 7 | 0,1 | |
| 51 | 1 | 95 | 95 | Q11RES08 | QUESTION 11, RESPONSE 8 | 0,1 | |
| 52 | 1 | 96 | 96 | Q11RES09 | QUESTION 11, RESPONSE 9 | 0,1 | |
| 53 | 1 | 97 | 97 | Q12 | QUESTION 12 | 1-4 | |

| FLD# | NC | SC | EC | NAME | DESCRIPTION | RANGE | |
|---|---|---|---|---|---|---|---|
| 54 | 1 | 98 | 98 | Q13 | QUESTION 13 | 1-5 | |
| 55 | 1 | 99 | 99 | Q14 | QUESTION 14 | 1-5 | |
| 56 | 1 | 100 | 100 | Q15 | QUESTION 15 | 1-5 | |
| 57 | 1 | 101 | 101 | Q16 | QUESTION 16 | 1-5 | |
| 58 | 1 | 102 | 102 | Q17 | QUESTION 17 | 1-5 | |
| 59 | 1 | 103 | 103 | Q18 | QUESTION 18 | 1-5 | |
| 60 | 1 | 104 | 104 | Q19 | QUESTION 19 | 1-5 | |
| 61 | 1 | 105 | 105 | Q20 | QUESTION 20 | | A-F |
| 62 | 1 | 106 | 106 | Q21RES01 | QUESTION 21, RESPONSE 1 | 0,1 | |
| 63 | 1 | 107 | 107 | Q21RES02 | QUESTION 21, RESPONSE 2 | 0,1 | |
| 64 | 1 | 108 | 108 | Q21RES03 | QUESTION 21, RESPONSE 3 | 0,1 | |
| 65 | 1 | 109 | 109 | Q21RES04 | QUESTION 21, RESPONSE 4 | 0,1 | |
| 66 | 1 | 110 | 110 | Q21RES05 | QUESTION 21, RESPONSE 5 | 0,1 | |
| 67 | 1 | 111 | 111 | Q21RES06 | QUESTION 21, RESPONSE 6 | 0,1 | |
| 68 | 1 | 112 | 112 | Q22RES01 | QUESTION 22, RESPONSE 1 | 0,1 | |
| 69 | 1 | 113 | 113 | Q22RES02 | QUESTION 22, RESPONSE 2 | 0,1 | |
| 70 | 1 | 114 | 114 | Q22RES03 | QUESTION 22, RESPONSE 3 | 0,1 | |
| 71 | 1 | 115 | 115 | Q22RES04 | QUESTION 22, RESPONSE 4 | 0,1 | |
| 72 | 1 | 116 | 116 | Q22RES05 | QUESTION 22, RESPONSE 5 | 0,1 | |
| 73 | 1 | 117 | 117 | Q22RES06 | QUESTION 22, RESPONSE 6 | 0,1 | |
| 74 | 1 | 118 | 118 | Q22RES07 | QUESTION 22, RESPONSE 7 | 0,1 | |
| 75 | 1 | 119 | 119 | Q22RES08 | QUESTION 22, RESPONSE 8 | 0,1 | |
| 76 | 1 | 120 | 120 | Q22RES09 | QUESTION 22, RESPONSE 9 | 0,1 | |
| 77 | 1 | 121 | 121 | Q22RES10 | QUESTION 22, RESPONSE 10 | 0,1 | |
| 78 | 1 | 122 | 122 | Q22RES11 | QUESTION 22, RESPONSE 11 | 0,1 | |
| 79 | 1 | 123 | 123 | Q23 | QUESTION 23 | | A-F |
| 80 | 1 | 124 | 124 | Q24RES01 | QUESTION 24, RESPONSE 1 | 0,1 | |
| 81 | 1 | 125 | 125 | Q24RES02 | QUESTION 24, RESPONSE 2 | 0,1 | |
| 82 | 1 | 126 | 126 | Q24RES03 | QUESTION 24, RESPONSE 3 | 0,1 | |
| 83 | 1 | 127 | 127 | Q24RES04 | QUESTION 24, RESPONSE 4 | 0,1 | |
| 84 | 1 | 128 | 128 | Q24RES05 | QUESTION 24, RESPONSE 5 | 0,1 | |
| 85 | 1 | 129 | 129 | Q24RES06 | QUESTION 24, RESPONSE 6 | 0,1 | |
| 86 | 1 | 130 | 130 | Q24RES07 | QUESTION 24, RESPONSE 7 | 0,1 | |
| 87 | 1 | 131 | 131 | Q24RES08 | QUESTION 24, RESPONSE 8 | 0,1 | |
| 88 | 1 | 132 | 132 | Q24RES09 | QUESTION 24, RESPONSE 9 | 0,1 | |
| 89 | 1 | 133 | 133 | Q25 | QUESTION 25 | | A-F |
| 90 | 1 | 134 | 134 | Q26 | QUESTION 26 | | A-C |
| 91 | 1 | 135 | 135 | Q27 | QUESTION 27 | 1-5 | |
| 92 | 1 | 136 | 136 | Q28RES01 | QUESTION 28, RESPONSE 1 | 0,1 | |
| 93 | 1 | 137 | 137 | Q28RES02 | QUESTION 28, RESPONSE 2 | 0,1 | |
| 94 | 1 | 138 | 138 | Q28RES03 | QUESTION 28, RESPONSE 3 | 0,1 | |
| 95 | 1 | 139 | 139 | Q28RES04 | QUESTION 28, RESPONSE 4 | 0,1 | |
| 96 | 1 | 140 | 140 | Q28RES05 | QUESTION 28, RESPONSE 5 | 0,1 | |
| 97 | 1 | 141 | 141 | Q29RES01 | QUESTION 29, RESPONSE 1 | 0,1 | |
| 98 | 1 | 142 | 142 | Q29RES02 | QUESTION 29, RESPONSE 2 | 0,1 | |
| 99 | 1 | 143 | 143 | Q29RES03 | QUESTION 29, RESPONSE 3 | 0,1 | |
| 100 | 1 | 144 | 144 | Q29RES04 | QUESTION 29, RESPONSE 4 | 0,1 | |
| 101 | 1 | 145 | 145 | Q29RES05 | QUESTION 29, RESPONSE 5 | 0,1 | |
| 102 | 1 | 146 | 146 | Q29RES06 | QUESTION 29, RESPONSE 6 | 0,1 | |
| 103 | 1 | 147 | 147 | Q29RES07 | QUESTION 29, RESPONSE 7 | 0,1 | |
| 104 | 1 | 148 | 148 | Q29RES08 | QUESTION 29, RESPONSE 8 | 0,1 | |
| 105 | 1 | 149 | 149 | Q30 | QUESTION 30 | 1-5 | |
| 106 | 1 | 150 | 150 | Q31 | QUESTION 31 | 1-5 | |
| 107 | 1 | 151 | 151 | Q32 | QUESTION 32 | 1-5 | |
| 108 | 1 | 152 | 152 | Q33 | QUESTION 33 | 1-5 | |

| FLD# | NC | SC | EC | NAME | DESCRIPTION | RANGE |
|---|---|---|---|---|---|---|
| 109 | 1 | 153 | 153 | Q34 | QUESTION 34 | 1-5 |
| 110 | 1 | 154 | 154 | Q35 | QUESTION 35 | A-F |
| 111 | 1 | 155 | 155 | Q36RES01 | QUESTION 36, RESPONSE 1 | 0,1 |
| 112 | 1 | 156 | 156 | Q36RES02 | QUESTION 36, RESPONSE 2 | 0,1 |
| 113 | 1 | 157 | 157 | Q36RES36 | QUESTION 36, RESPONSE 3 | 0,1 |
| 114 | 1 | 158 | 158 | Q36RES04 | QUESTION 36, RESPONSE 4 | 0,1 |
| 115 | 1 | 159 | 159 | Q36RES05 | QUESTION 36, RESPONSE 5 | 0,1 |
| 116 | 1 | 160 | 160 | Q36RES06 | QUESTION 36, RESPONSE 6 | 0,1 |
| 117 | 1 | 161 | 161 | Q36RES07 | QUESTION 36, RESPONSE 7 | 0,1 |
| 118 | 1 | 162 | 162 | Q37 | QUESTION 37 | A-C |
| 119 | 1 | 163 | 163 | Q38RES01 | QUESTION 38, RESPONSE 1 | 0,1 |
| 120 | 1 | 164 | 164 | Q38RES02 | QUESTION 38, RESPONSE 2 | 0,1 |
| 121 | 1 | 165 | 165 | Q38RES03 | QUESTION 38, RESPONSE 3 | 0,1 |
| 122 | 1 | 166 | 166 | Q38RES04 | QUESTION 38, RESPONSE 4 | 0,1 |
| 123 | 1 | 167 | 167 | Q39RES01 | QUESTION 39, RESPONSE 1 | 0,1 |
| 124 | 1 | 168 | 168 | Q39RES02 | QUESTION 39, RESPONSE 2 | 0,1 |
| 125 | 1 | 169 | 169 | Q39RES03 | QUESTION 39, RESPONSE 3 | 0,1 |
| 126 | 1 | 170 | 170 | Q39RES04 | QUESTION 39, RESPONSE 4 | 0,1 |
| 127 | 1 | 171 | 171 | Q39RES05 | QUESTION 39, RESPONSE 5 | 0,1 |
| 128 | 1 | 172 | 172 | Q39RES06 | QUESTION 39, RESPONSE 6 | 0,1 |
| 129 | 1 | 173 | 173 | Q39RES07 | QUESTION 39, RESPONSE 7 | 0,1 |
| 130 | 1 | 174 | 174 | Q40 | QUESTION 40 | A-F |
| 131 | 1 | 175 | 175 | Q41RES01 | QUESTION 41, RESPONSE 1 | 0,1 |
| 132 | 1 | 176 | 176 | Q41RES02 | QUESTION 41, RESPONSE 2 | 0,1 |
| 133 | 1 | 177 | 177 | Q41RES03 | QUESTION 41, RESPONSE 3 | 0,1 |
| 134 | 1 | 178 | 178 | Q41RES04 | QUESTION 41, RESPONSE 4 | 0,1 |
| 135 | 1 | 179 | 179 | Q41RES05 | QUESTION 41, RESPONSE 5 | 0,1 |
| 136 | 1 | 180 | 180 | Q41RES06 | QUESTION 41, RESPONSE 6 | 0,1 |
| 137 | 1 | 181 | 181 | Q41RES07 | QUESTION 41, RESPONSE 7 | 0,1 |
| 138 | 1 | 182 | 182 | Q42RES01 | QUESTION 42, RESPONSE 1 | 0,1 |
| 139 | 1 | 183 | 183 | Q42RES02 | QUESTION 42, RESPONSE 2 | 0,1 |
| 140 | 1 | 184 | 184 | Q42RES03 | QUESTION 42, RESPONSE 3 | 0,1 |
| 141 | 1 | 185 | 185 | Q42RES04 | QUESTION 42, RESPONSE 4 | 0,1 |
| 142 | 1 | 186 | 186 | Q42RES05 | QUESTION 42, RESPONSE 5 | 0,1 |
| 143 | 1 | 187 | 187 | Q42RES06 | QUESTION 42, RESPONSE 6 | 0,1 |
| 144 | 1 | 188 | 188 | Q42RES07 | QUESTION 42, RESPONSE 7 | 0,1 |
| 145 | 1 | 189 | 189 | Q42RES08 | QUESTION 42, RESPONSE 8 | 0,1 |
| 146 | 1 | 190 | 190 | Q43RES01 | QUESTION 43, RESPONSE 1 | 0,1 |
| 147 | 1 | 191 | 191 | Q43RES02 | QUESTION 43, RESPONSE 2 | 0,1 |
| 148 | 1 | 192 | 192 | Q43RES03 | QUESTION 43, RESPONSE 3 | 0,1 |
| 149 | 1 | 193 | 193 | Q43RES04 | QUESTION 43, RESPONSE 4 | 0,1 |
| 150 | 1 | 194 | 194 | Q43RES05 | QUESTION 43, RESPONSE 5 | 0,1 |
| 151 | 1 | 195 | 195 | Q43RES06 | QUESTION 43, RESPONSE 6 | 0,1 |
| 152 | 1 | 196 | 196 | Q43RES07 | QUESTION 43, RESPONSE 7 | 0,1 |
| 153 | 1 | 197 | 197 | Q43RES08 | QUESTION 43, RESPONSE 8 | 0,1 |
| 154 | 1 | 198 | 198 | Q44RES01 | QUESTION 44, RESPONSE 1 | 0,1 |
| 155 | 1 | 199 | 199 | Q44RES02 | QUESTION 44, RESPONSE 2 | 0,1 |
| 156 | 1 | 200 | 200 | Q44RES03 | QUESTION 44, RESPONSE 3 | 0,1 |
| 157 | 1 | 201 | 201 | Q44RES04 | QUESTION 44, RESPONSE 4 | 0,1 |
| 158 | 1 | 202 | 202 | Q44RES05 | QUESTION 44, RESPONSE 5 | 0,1 |
| 159 | 1 | 203 | 203 | Q44RES06 | QUESTION 44, RESPONSE 6 | 0,1 |
| 160 | 1 | 204 | 204 | Q44RES07 | QUESTION 44, RESPONSE 7 | 0,1 |
| 161 | 1 | 205 | 205 | Q45RES01 | QUESTION 45, RESPONSE 1 | 0,1 |
| 162 | 1 | 206 | 206 | Q45RES02 | QUESTION 45, RESPONSE 2 | 0,1 |
| 163 | 1 | 207 | 207 | Q45RES03 | QUESTION 45, RESPONSE 3 | 0,1 |

| FLD# | NC | SC | EC | NAME | DESCRIPTION | RANGE |
|---|---|---|---|---|---|---|
| 164 | 1 | 208 | 208 | Q45RES04 | QUESTION 45, RESPONSE 4 | 0,1 |
| 165 | 1 | 209 | 209 | Q45RES05 | QUESTION 45, RESPONSE 5 | 0,1 |
| 166 | 1 | 210 | 210 | Q45RES06 | QUESTION 45, RESPONSE 6 | 0,1 |
| 167 | 1 | 211 | 211 | Q46RES01 | QUESTION 46, RESPONSE 1 | 0,1 |
| 168 | 1 | 212 | 212 | Q46RES02 | QUESTION 46, RESPONSE 2 | 0,1 |
| 169 | 1 | 213 | 213 | Q46RES03 | QUESTION 46, RESPONSE 3 | 0,1 |
| 170 | 1 | 214 | 214 | Q46RES04 | QUESTION 46, RESPONSE 4 | 0,1 |
| 171 | 1 | 215 | 215 | Q46RES05 | QUESTION 46, RESPONSE 5 | 0,1 |
| 172 | 1 | 216 | 216 | Q46RES06 | QUESTION 46, RESPONSE 6 | 0,1 |
| 173 | 1 | 217 | 217 | Q47 | QUESTION 47 | 1-5 |
| 174 | 1 | 218 | 218 | Q48 | QUESTION 48 | 1-5 |
| 175 | 1 | 219 | 219 | Q49 | QUESTION 49 | 1-5 |
| 176 | 1 | 220 | 220 | Q50 | QUESTION 50 | 1-5 |
| 177 | 1 | 221 | 221 | Q51 | QUESTION 51 | 1-5 |
| 178 | 1 | 222 | 222 | Q52 | QUESTION 52 | 1-5 |
| 179 | 1 | 223 | 223 | Q53 | QUESTION 53 | 1-5 |
| 180 | 1 | 224 | 224 | Q54 | QUESTION 54 | 1-5 |
| 181 | 1 | 225 | 225 | Q55 | QUESTION 55 | 1-5 |
| 182 | 1 | 226 | 226 | Q56 | QUESTION 56 | 1-5 |
| 183 | 1 | 227 | 227 | Q57 | QUESTION 57 | A-G |
| 184 | 1 | 228 | 728 | Q58RES01 | QUESTION 58, RESPONSE 1 | 0,1 |
| 185 | 1 | 229 | 229 | Q58RES02 | QUESTION 58, RESPONSE 2 | 0,1 |
| 186 | 1 | 230 | 230 | Q58RES03 | QUESTION 58, RESPONSE 3 | 0,1 |
| 187 | 1 | 231 | 231 | Q58RES04 | QUESTION 58, RESPONSE 4 | 0,1 |
| 188 | 1 | 232 | 232 | Q58RES05 | QUESTION 58, RESPONSE 5 | 0,1 |
| 189 | 1 | 233 | 233 | Q58RES06 | QUESTION 58, RESPONSE 6 | 0,1 |
| 190 | 1 | 234 | 234 | Q58RES07 | QUESTION 58, RESPONSE 7 | 0,1 |
| 191 | 1 | 235 | 235 | Q58RES08 | QUESTION 58, RESPONSE 8 | 0,1 |
| 192 | 1 | 236 | 236 | Q58RES09 | QUESTION 58, RESPONSE 9 | 0,1 |
| 193 | 1 | 237 | 237 | Q59 | QUESTION 59 | A-I |
| 194 | 1 | 238 | 238 | Q60RES01 | QUESTION 60, RESPONSE 1 | 0,1 |
| 195 | 1 | 239 | 239 | Q60RES02 | QUESTION 60, RESPONSE 2 | 0,1 |
| 196 | 1 | 240 | 240 | Q60RES60 | QUESTION 60, RESPONSE 3 | 0,1 |
| 197 | 1 | 241 | 241 | Q60RES04 | QUESTION 60, RESPONSE 4 | 0,1 |
| 198 | 1 | 242 | 242 | Q60RES05 | QUESTION 60, RESPONSE 5 | 0,1 |
| 199 | 1 | 243 | 243 | Q60RES06 | QUESTION 60, RESPONSE 6 | 0,1 |
| 200 | 1 | 244 | 244 | Q60RES07 | QUESTION 60, RESPONSE 7 | 0,1 |
| 201 | 1 | 245 | 245 | Q60RES08 | QUESTION 60, RESPONSE 8 | 0,1 |
| 202 | 1 | 246 | 246 | Q60RES09 | QUESTION 60, RESPONSE 9 | 0,1 |
| 203 | 1 | 247 | 247 | Q61 | QUESTION 61 | A-E |
| 204 | 1 | 248 | 248 | Q62 | QUESTION 62 | A-E |
| 205 | 1 | 249 | 249 | Q63RES01 | QUESTION 63, RESPONSE 1 | 0,1 |
| 206 | 1 | 250 | 250 | Q63RES02 | QUESTION 63, RESPONSE 2 | 0,1 |
| 207 | 1 | 251 | 251 | Q63RES03 | QUESTION 63, RESPONSE 3 | 0,1 |
| 208 | 1 | 252 | 252 | Q63RES04 | QUESTION 63, RESPONSE 4 | 0,1 |
| 209 | 1 | 253 | 253 | Q63RES05 | QUESTION 63, RESPONSE 5 | 0,1 |
| 210 | 1 | 254 | 254 | Q63RES06 | QUESTION 63, RESPONSE 6 | 0,1 |
| 211 | 1 | 255 | 255 | Q63RES07 | QUESTION 63, RESPONSE 7 | 0,1 |
| 212 | 1 | 256 | 256 | Q64RES01 | QUESTION 64, RESPONSE 1 | 0,1 |
| 213 | 1 | 257 | 257 | Q64RES02 | QUESTION 64, RESPONSE 2 | 0,1 |
| 214 | 1 | 258 | 258 | Q64RES03 | QUESTION 64, RESPONSE 3 | 0,1 |
| 215 | 1 | 259 | 259 | Q64RES04 | QUESTION 64, RESPONSE 4 | 0,1 |
| 216 | 1 | 260 | 260 | Q64RES05 | QUESTION 64, RESPONSE 5 | 0,1 |
| 217 | 1 | 261 | 261 | Q64RES06 | QUESTION 64, RESPONSE 6 | 0,1 |
| 218 | 1 | 262 | 262 | Q64RES07 | QUESTION 64, RESPONSE 7 | 0,1 |

| FLD# | NC | SC | EC | NAME | DESCRIPTION | RANGE |
|---|---|---|---|---|---|---|
| 219 | 1 | 263 | 263 | Q65 | QUESTION 65 | A-G |
| 220 | 1 | 264 | 264 | Q66 | QUESTION 66 | A-G |
| 221 | 1 | 265 | 265 | Q67 | QUESTION 67 | A-F |
| 222 | 1 | 266 | 266 | Q68 | QUESTION 68 | A-F |
| 223 | 1 | 267 | 267 | Q69 | QUESTION 69 | A-F |
| 224 | 1 | 268 | 268 | Q70RES01 | QUESTION 70, RESPONSE 1 | 0,1 |
| 225 | 1 | 269 | 269 | Q70RES02 | QUESTION 70, RESPONSE 2 | 0,1 |
| 226 | 1 | 270 | 270 | Q70RES03 | QUESTION 70, RESPONSE 3 | 0,1 |
| 227 | 1 | 271 | 271 | Q70RES04 | QUESTION 70, RESPONSE 4 | 0,1 |
| 228 | 1 | 272 | 272 | Q70RES05 | QUESTION 70, RESPONSE 5 | 0,1 |
| 229 | 1 | 273 | 273 | Q71 | QUESTION 71 | A-D |
| 230 | 1 | 274 | 274 | Q72RES01 | QUESTION 72, RESPONSE 1 | 0,1 |
| 231 | 1 | 275 | 275 | Q72RES02 | QUESTION 72, RESPONSE 2 | 0,1 |
| 232 | 1 | 276 | 276 | Q72RES03 | QUESTION 72, RESPONSE 3 | 0,1 |
| 233 | 1 | 277 | 277 | Q72RES04 | QUESTION 72, RESPONSE 4 | 0,1 |
| 234 | 1 | 278 | 278 | Q72RES05 | QUESTION 72, RESPONSE 5 | 0,1 |
| 235 | 1 | 279 | 279 | Q72RES06 | QUESTION 72, RESPONSE 6 | 0,1 |
| 236 | 1 | 280 | 280 | Q72RES07 | QUESTION 72, RESPONSE 7 | 0,1 |
| 237 | 1 | 281 | 281 | Q73 | QUESTION 73 | A-F |
| 238 | 1 | 282 | 282 | Q74RES01 | QUESTION 74, RESPONSE 1 | 0,1 |
| 239 | 1 | 283 | 283 | Q74RES02 | QUESTION 74, RESPONSE 2 | 0,1 |
| 240 | 1 | 284 | 284 | Q74RES03 | QUESTION 74, RESPONSE 3 | 0,1 |
| 241 | 1 | 285 | 285 | Q74RES04 | QUESTION 74, RESPONSE 4 | 0,1 |
| 242 | 1 | 286 | 286 | Q74RES05 | QUESTION 74, RESPONSE 5 | 0,1 |
| 243 | 1 | 287 | 287 | Q74RES06 | QUESTION 74, RESPONSE 6 | 0,1 |
| 244 | 1 | 288 | 288 | Q74RES07 | QUESTION 74, RESPONSE 7 | 0,1 |
| 245 | 1 | 289 | 289 | Q75RES01 | QUESTION 75, RESPONSE 1 | 0,1 |
| 246 | 1 | 290 | 290 | Q75RES02 | QUESTION 75, RESPONSE 2 | 0,1 |
| 247 | 1 | 291 | 291 | Q75RES03 | QUESTION 75, RESPONSE 3 | 0,1 |
| 248 | 1 | 292 | 292 | Q75RES04 | QUESTION 75, RESPONSE 4 | 0,1 |
| 249 | 1 | 293 | 293 | Q75RES05 | QUESTION 75, RESPONSE 5 | 0,1 |
| 250 | 1 | 294 | 294 | Q75RES06 | QUESTION 75, RESPONSE 6 | 0,1 |
| 251 | 1 | 295 | 295 | Q75RES07 | QUESTION 75, RESPONSE 7 | 0,1 |
| 252 | 1 | 296 | 296 | Q76RES01 | QUESTION 76, RESPONSE 1 | 0,1 |
| 253 | 1 | 297 | 297 | Q76RES02 | QUESTION 76, RESPONSE 2 | 0,1 |
| 254 | 1 | 298 | 298 | Q76RES03 | QUESTION 76, RESPONSE 3 | 0,1 |
| 255 | 1 | 299 | 299 | Q76RES04 | QUESTION 76, RESPONSE 4 | 0,1 |
| 256 | 1 | 300 | 300 | Q76RES05 | QUESTION 76, RESPONSE 5 | 0,1 |
| 257 | 1 | 301 | 301 | Q76RES06 | QUESTION 76, RESPONSE 6 | 0,1 |
| 258 | 1 | 302 | 302 | Q76RES07 | QUESTION 76, RESPONSE 7 | 0,1 |
| 259 | 1 | 303 | 303 | Q77RES01 | QUESTION 77, RESPONSE 1 | 0,1 |
| 260 | 1 | 304 | 304 | Q77RES02 | QUESTION 77, RESPONSE 2 | 0,1 |
| 261 | 1 | 305 | 305 | Q77RES03 | QUESTION 77, RESPONSE 3 | 0,1 |
| 262 | 1 | 306 | 306 | Q77RES04 | QUESTION 77, RESPONSE 4 | 0,1 |
| 263 | 1 | 307 | 307 | Q77RES05 | QUESTION 77, RESPONSE 5 | 0,1 |
| 264 | 1 | 308 | 308 | Q77RES06 | QUESTION 77, RESPONSE 6 | 0,1 |
| 265 | 1 | 309 | 309 | Q77RES07 | QUESTION 77, RESPONSE 7 | 0,1 |
| 266 | 1 | 310 | 310 | Q78RES01 | QUESTION 78, RESPONSE 1 | 0,1 |
| 267 | 1 | 311 | 311 | Q78RES02 | QUESTION 78, RESPONSE 2 | 0,1 |
| 268 | 1 | 312 | 312 | Q78RES03 | QUESTION 78, RESPONSE 3 | 0,1 |
| 269 | 1 | 313 | 313 | Q78RES04 | QUESTION 78, RESPONSE 4 | 0,1 |
| 270 | 1 | 314 | 314 | Q78RES05 | QUESTION 78, RESPONSE 5 | 0,1 |
| 271 | 1 | 315 | 315 | Q78RES06 | QUESTION 78, RESPONSE 6 | 0,1 |
| 272 | 1 | 316 | 316 | Q78RES07 | QUESTION 78, RESPONSE 7 | 0,1 |
| 273 | 1 | 317 | 317 | Q79RES01 | QUESTION 79, RESPONSE 1 | 0,1 |

| FLD# | NC | SC | EC | NAME | DESCRIPTION | RANGE |
|---|---|---|---|---|---|---|
| 274 | 1 | 318 | 318 | Q79RES02 | QUESTION 79, RESPONSE 2 | 0,1 |
| 275 | 1 | 319 | 319 | Q79RES03 | QUESTION 79, RESPONSE 3 | 0,1 |
| 276 | 1 | 320 | 320 | Q79RES04 | QUESTION 79, RESPONSE 4 | 0,1 |
| 277 | 1 | 321 | 321 | Q79RES05 | QUESTION 79, RESPONSE 5 | 0,1 |
| 278 | 1 | 322 | 322 | Q79RES06 | QUESTION 79, RESPONSE 6 | 0,1 |
| 279 | 1 | 323 | 323 | Q79RES07 | QUESTION 79, RESPONSE 7 | 0,1 |
| 280 | 1 | 324 | 324 | Q80RES01 | QUESTION 80, RESPONSE 1 | 0,1 |
| 281 | 1 | 325 | 325 | Q80RES02 | QUESTION 80, RESPONSE 2 | 0,1 |
| 282 | 1 | 326 | 326 | Q80RES03 | QUESTION 80, RESPONSE 3 | 0,1 |
| 283 | 1 | 327 | 327 | Q80RES04 | QUESTION 80, RESPONSE 4 | 0,1 |
| 284 | 1 | 328 | 328 | Q80RES05 | QUESTION 80, RESPONSE 5 | 0,1 |
| 285 | 1 | 329 | 329 | Q80RES06 | QUESTION 80, RESPONSE 6 | 0,1 |
| 286 | 1 | 330 | 330 | Q80RES07 | QUESTION 80, RESPONSE 7 | 0,1 |
| 287 | 2 | 331 | 332 | MAJCOM | ASGT - CURRENT - MAJOR COMMAND ID | A-Z |
| 288 | 6 | 333 | 338 | PAFSC | AFSC - PRIMARY - NUMBER/SUFFIX | 0-9, A-C |
| 289 | 6 | 339 | 344 | DAFSC | AFSC - DUTY - NUMBER/SUFFIX | 0-9, A-C |
| 290 | 17 | 345 | 361 | DTYLOC | ASGT - DUTY LOCATION NAME | A-Z |
| 291 | 2 | 362 | 363 | GRADE | CURRENT GRADE | 0-9 |

# Appendix D-2

# Trainer Survey Code Sheets

# VER0003X: SLT SURVEY FORM FOR UNIT-LEVEL TRAINERS

| FLD# | NC | SC | EC | NAME | DESCRIPTION | RANGE | |
|---|---|---|---|---|---|---|---|
| 1 | 1 | 1 | 1 | LISTA | CODE FOR MAJ. COMMANDS | FIELD OPR. AGENCIES, ETC. | A-Z |
| 2 | 10 | 2 | 11 | FILLER | FILLER | BLANKS | |
| 3 | 1 | 12 | 12 | LISTB | CODE FOR DESCRIPTION OF UNIT OF ASSIGNMENT | | A-Z |
| 4 | 14 | 13 | 26 | FILLER | FILLER | BLANKS | |
| 5 | 9 | 27 | 35 | SSAN | SOCIAL SECURITY ACCT NUMBER | 0-9 | |
| 6 | 4 | 36 | 39 | VERSION | VERSION NUMBER | 0-9 | |
| 7 | 12 | 40 | 51 | FILLER | FILLER | BLANKS | |
| 8 | 1 | 52 | 52 | Q01 | QUESTION 1 | | A-I |
| 9 | 1 | 53 | 53 | Q02 | QUESTION 2 | | A-E |
| 10 | 1 | 54 | 54 | Q03RES01 | QUESTION 3, RESPONSE 1 | 0,1 | |
| 11 | 1 | 55 | 55 | Q03RES02 | QUESTION 3, RESPONSE 2 | 0,1 | |
| 12 | 1 | 56 | 56 | Q03RES03 | QUESTION 3, RESPONSE 3 | 0,1 | |
| 13 | 1 | 57 | 57 | Q03RES04 | QUESTION 3, RESPONSE 4 | 0,1 | |
| 14 | 1 | 58 | 58 | Q03RES05 | QUESTION 3, RESPONSE 5 | 0,1 | |
| 15 | 1 | 59 | 59 | Q03RES06 | QUESTION 3, RESPONSE 6 | 0,1 | |
| 16 | 1 | 60 | 60 | Q04 | QUESTION 4 | | A-E |
| 17 | 1 | 61 | 61 | Q05RES01 | QUESTION 5, RESPONSE 1 | 0,1 | |
| 18 | 1 | 62 | 62 | Q05RES02 | QUESTION 5, RESPONSE 2 | 0,1 | |
| 19 | 1 | 63 | 63 | Q05RES03 | QUESTION 5, RESPONSE 3 | 0,1 | |
| 20 | 1 | 64 | 64 | Q05RES04 | QUESTION 5, RESPONSE 4 | 0,1 | |
| 21 | 1 | 65 | 65 | Q05RES05 | QUESTION 5, RESPONSE 5 | 0,1 | |
| 22 | 1 | 66 | 66 | Q05RES06 | QUESTION 5, RESPONSE 6 | 0,1 | |
| 23 | 1 | 67 | 67 | Q06 | QUESTION 6 | | A-F |
| 24 | 1 | 68 | 68 | Q07 | QUESTION 7 | | A-D |
| 25 | 1 | 69 | 69 | Q08RES01 | QUESTION 8, RESPONSE 1 | 0,1 | |
| 26 | 1 | 70 | 70 | Q08RES02 | QUESTION 8, RESPONSE 2 | 0,1 | |
| 27 | 1 | 71 | 71 | Q08RES03 | QUESTION 8, RESPONSE 3 | 0,1 | |
| 28 | 1 | 72 | 72 | Q08RES04 | QUESTION 8, RESPONSE 4 | 0,1 | |
| 29 | 1 | 73 | 73 | Q08RES05 | QUESTION 8, RESPONSE 5 | 0,1 | |
| 30 | 1 | 74 | 74 | Q08RES06 | QUESTION 8, RESPONSE 6 | 0,1 | |
| 31 | 1 | 75 | 75 | Q09RES01 | QUESTION 9, RESPONSE 1 | 0,1 | |
| 32 | 1 | 76 | 76 | Q09RES02 | QUESTION 9, RESPONSE 2 | 0,1 | |
| 33 | 1 | 77 | 77 | Q09RES03 | QUESTION 9, RESPONSE 3 | 0,1 | |
| 34 | 1 | 78 | 78 | Q09RES04 | QUESTION 9, RESPONSE 4 | 0,1 | |
| 35 | 1 | 79 | 79 | Q09RES05 | QUESTION 9, RESPONSE 5 | 0,1 | |
| 36 | 1 | 80 | 80 | Q09RES06 | QUESTION 9, RESPONSE 6 | 0,1 | |
| 37 | 1 | 81 | 81 | Q09RES07 | QUESTION 9, RESPONSE 7 | 0,1 | |
| 38 | 1 | 82 | 82 | Q09RES08 | QUESTION 9, RESPONSE 8 | 0,1 | |
| 39 | 1 | 83 | 83 | Q09RES09 | QUESTION 9, RESPONSE 9 | 0,1 | |
| 40 | 1 | 84 | 84 | Q09RES10 | QUESTION 9, RESPONSE 10 | 0,1 | |
| 41 | 1 | 85 | 85 | Q10 | QUESTION 10 | | A-E |
| 42 | 1 | 86 | 86 | Q11 | QUESTION 11 | 1-4 | |
| 43 | 1 | 87 | 87 | Q12 | QUESTION 12 | 1-4 | |
| 44 | 1 | 88 | 88 | Q13 | QUESTION 13 | 1-4 | |
| 45 | 1 | 89 | 89 | Q14 | QUESTION 14 | 1-4 | |
| 46 | 1 | 90 | 90 | Q15 | QUESTION 15 | 1-4 | |
| 47 | 1 | 91 | 91 | Q16 | QUESTION 16 | 1-4 | |
| 48 | 1 | 92 | 92 | Q17 | QUESTION 17 | 1-4 | |
| 49 | 1 | 93 | 93 | Q18 | QUESTION 18 | 1-4 | |
| 50 | 1 | 94 | 94 | Q19 | QUESTION 19 | 1-4 | |
| 51 | 1 | 95 | 95 | Q20 | QUESTION 20 | 1-4 | |
| 52 | 1 | 96 | 96 | Q21 | QUESTION 21 | | A-F |
| 53 | 1 | 97 | 97 | Q22RES01 | QUESTION 22, RESPONSE 1 | 0,1 | |

| FLD# | NC | SC | EC | NAME | DESCRIPTION | RANGE |
|---|---|---|---|---|---|---|
| 54 | 1 | 98 | 98 | Q22RES02 | QUESTION 22, RESPONSE 2 | 0,1 |
| 55 | 1 | 99 | 99 | Q22RES03 | QUESTION 22, RESPONSE 3 | 0,1 |
| 56 | 1 | 100 | 100 | Q22RES04 | QUESTION 22, RESPONSE 4 | 0,1 |
| 57 | 1 | 101 | 101 | Q22RES05 | QUESTION 22, RESPONSE 5 | 0,1 |
| 58 | 1 | 102 | 102 | Q22RES06 | QUESTION 22, RESPONSE 6 | 0,1 |
| 59 | 1 | 103 | 103 | Q23RES01 | QUESTION 23, RESPONSE 1 | 0,1 |
| 60 | 1 | 104 | 104 | Q23RES02 | QUESTION 23, RESPONSE 2 | 0,1 |
| 61 | 1 | 105 | 105 | Q23RES03 | QUESTION 23, RESPONSE 3 | 0,1 |
| 62 | 1 | 106 | 106 | Q23RES04 | QUESTION 23, RESPONSE 4 | 0,1 |
| 63 | 1 | 107 | 107 | Q23RES05 | QUESTION 23, RESPONSE 5 | 0,1 |
| 64 | 1 | 108 | 108 | Q23RES06 | QUESTION 23, RESPONSE 6 | 0,1 |
| 65 | 1 | 109 | 109 | Q23RES07 | QUESTION 23, RESPONSE 7 | 0,1 |
| 66 | 1 | 110 | 110 | Q23RES08 | QUESTION 23, RESPONSE 8 | 0,1 |
| 67 | 1 | 111 | 111 | Q23RES09 | QUESTION 23, RESPONSE 9 | 0,1 |
| 68 | 1 | 112 | 112 | Q23RES10 | QUESTION 23, RESPONSE 10 | 0,1 |
| 69 | 1 | 113 | 113 | Q23RES11 | QUESTION 23, RESPONSE 11 | 0,1 |
| 70 | 1 | 114 | 114 | Q23RES12 | QUESTION 23, RESPONSE 12 | 0,1 |
| 71 | 1 | 115 | 115 | Q24 | QUESTION 24 | A-F |
| 72 | 1 | 116 | 116 | Q25RES01 | QUESTION 25, RESPONSE 1 | 0,1 |
| 73 | 1 | 117 | 117 | Q25RES02 | QUESTION 25, RESPONSE 2 | 0,1 |
| 74 | 1 | 118 | 118 | Q25RES03 | QUESTION 25, RESPONSE 3 | 0,1 |
| 75 | 1 | 119 | 119 | Q25RES04 | QUESTION 25, RESPONSE 4 | 0,1 |
| 76 | 1 | 120 | 120 | Q25RES05 | QUESTION 25, RESPONSE 5 | 0,1 |
| 77 | 1 | 121 | 121 | Q25RES06 | QUESTION 25, RESPONSE 6 | 0,1 |
| 78 | 1 | 122 | 122 | Q25RES07 | QUESTION 25, RESPONSE 7 | 0,1 |
| 79 | 1 | 123 | 123 | Q25RES08 | QUESTION 25, RESPONSE 8 | 0,1 |
| 80 | 1 | 124 | 124 | Q25RES09 | QUESTION 25, RESPONSE 9 | 0,1 |
| 81 | 1 | 125 | 125 | Q26 | QUESTION 26 | A-D |
| 82 | 1 | 126 | 126 | Q27 | QUESTION 27 | A-F |
| 83 | 1 | 127 | 127 | Q28 | QUESTION 28 | A-E |
| 84 | 1 | 128 | 128 | Q29 | QUESTION 29 | A-E |
| 85 | 1 | 129 | 129 | Q30 | QUESTION 30 | A-E |
| 86 | 1 | 130 | 130 | Q31 | QUESTION 31 | A-E |
| 87 | 1 | 131 | 131 | Q32 | QUESTION 32 | A-E |
| 88 | 1 | 132 | 132 | Q33 | QUESTION 33 | A-E |
| 89 | 1 | 133 | 133 | Q34 | QUESTION 34 | A-E |
| 90 | 1 | 134 | 134 | Q35 | QUESTION 35 | A-E |
| 91 | 1 | 135 | 135 | Q36 | QUESTION 36 | 1-7 |
| 92 | 1 | 136 | 136 | Q37 | QUESTION 37 | 1-7 |
| 93 | 1 | 137 | 137 | Q38 | QUESTION 38 | 1-7 |
| 94 | 1 | 138 | 138 | Q39 | QUESTION 39 | 1-7 |
| 95 | 1 | 139 | 139 | Q40 | QUESTION 40 | 1-7 |
| 96 | 1 | 140 | 140 | Q41 | QUESTION 41 | 1-7 |
| 97 | 1 | 141 | 141 | Q42 | QUESTION 42 | 1-7 |
| 98 | 1 | 142 | 142 | Q43 | QUESTION 43 | 1-7 |
| 99 | 1 | 143 | 143 | Q44 | QUESTION 44 | 1-6 |
| 100 | 1 | 144 | 144 | Q45 | QUESTION 45 | 1-6 |
| 101 | 1 | 145 | 145 | Q46 | QUESTION 46 | 1-6 |
| 102 | 1 | 146 | 146 | Q47 | QUESTION 47 | 1-6 |
| 103 | 1 | 147 | 147 | Q48 | QUESTION 48 | 1-6 |
| 104 | 1 | 148 | 148 | Q49 | QUESTION 49 | 1-6 |
| 105 | 1 | 149 | 149 | Q50 | QUESTION 50 | 1-6 |
| 106 | 1 | 150 | 150 | Q51 | QUESTION 51 | 1-6 |
| 107 | 1 | 151 | 151 | Q52 | QUESTION 52 | 1-5 |
| 108 | 1 | 152 | 152 | Q53 | QUESTION 53 | 1-5 |

| FLD# | NC | SC | EC | NAME | DESCRIPTION | RANGE | |
|---|---|---|---|---|---|---|---|
| 109 | 1 | 153 | 153 | Q54 | QUESTION 54 | 1-5 | |
| 110 | 1 | 154 | 154 | Q55 | QUESTION 55 | 1-5 | |
| 111 | 1 | 155 | 155 | Q56 | QUESTION 56 | 1-5 | |
| 112 | 1 | 156 | 156 | Q57 | QUESTION 57 | 1-5 | |
| 113 | 1 | 157 | 157 | Q58 | QUESTION 58 | 1-5 | |
| 114 | 1 | 158 | 158 | Q59 | QUESTION 59 | 1-5 | |
| 115 | 1 | 159 | 159 | Q60 | QUESTION 60 | 1-5 | |
| 116 | 1 | 160 | 160 | Q61 | QUESTION 61 | 1-5 | |
| 117 | 1 | 161 | 161 | Q62 | QUESTION 62 | 1-5 | |
| 118 | 1 | 162 | 162 | Q63 | QUESTION 63 | 1-5 | |
| 119 | 1 | 163 | 163 | Q64RES01 | QUESTION 64, RESPONSE 1 | 0,1 | |
| 120 | 1 | 164 | 164 | Q64RES02 | QUESTION 64, RESPONSE 2 | 0,1 | |
| 121 | 1 | 165 | 165 | Q64RES03 | QUESTION 64, RESPONSE 3 | 0,1 | |
| 122 | 1 | 166 | 166 | Q64RES04 | QUESTION 64, RESPONSE 4 | 0,1 | |
| 123 | 1 | 167 | 167 | Q64RES05 | QUESTION 64, RESPONSE 5 | 0,1 | |
| 124 | 1 | 168 | 168 | Q64RES06 | QUESTION 64, RESPONSE 6 | 0,1 | |
| 125 | 1 | 169 | 169 | Q64RES07 | QUESTION 64, RESPONSE 7 | 0,1 | |
| 126 | 1 | 170 | 170 | Q64RES08 | QUESTION 64, RESPONSE 8 | 0,1 | |
| 127 | 1 | 171 | 171 | Q64RES09 | QUESTION 64, RESPONSE 9 | 0,1 | |
| 128 | 1 | 172 | 172 | Q64RES10 | QUESTION 64, RESPONSE 10 | 0,1 | |
| 129 | 1 | 173 | 173 | Q65 | QUESTION 65 | | A-J |
| 130 | 1 | 174 | 174 | Q66RES01 | QUESTION 66, RESPONSE 1 | 0,1 | |
| 131 | 1 | 175 | 175 | Q66RES02 | QUESTION 66, RESPONSE 2 | 0,1 | |
| 132 | 1 | 176 | 176 | Q66RES03 | QUESTION 66, RESPONSE 3 | 0,1 | |
| 133 | 1 | 177 | 177 | Q66RES04 | QUESTION 66, RESPONSE 4 | 0,1 | |
| 134 | 1 | 178 | 178 | Q66RES05 | QUESTION 66, RESPONSE 5 | 0,1 | |
| 135 | 1 | 179 | 179 | Q66RES06 | QUESTION 66, RESPONSE 6 | 0,1 | |
| 136 | 1 | 180 | 180 | Q66RES07 | QUESTION 66, RESPONSE 7 | 0,1 | |
| 137 | 1 | 181 | 181 | Q66RES08 | QUESTION 66, RESPONSE 8 | 0,1 | |
| 138 | 1 | 182 | 182 | Q66RES09 | QUESTION 66, RESPONSE 9 | 0,1 | |
| 139 | 1 | 183 | 183 | Q66RES10 | QUESTION 66, RESPONSE 10 | 0,1 | |
| 140 | 1 | 184 | 184 | Q67 | QUESTION 67 | | A-D |
| 141 | 1 | 185 | 185 | Q68 | QUESTION 68 | | A-D |
| 142 | 1 | 186 | 186 | Q69RES01 | QUESTION 69, RESPONSE 1 | 0,1 | |
| 143 | 1 | 187 | 187 | Q69RES02 | QUESTION 69, RESPONSE 2 | 0,1 | |
| 144 | 1 | 188 | 188 | Q69RES03 | QUESTION 69, RESPONSE 3 | 0,1 | |
| 145 | 1 | 189 | 189 | Q69RES04 | QUESTION 69, RESPONSE 4 | 0,1 | |
| 146 | 1 | 190 | 190 | Q69RES05 | QUESTION 69, RESPONSE 5 | 0,1 | |
| 147 | 1 | 191 | 191 | Q69RES06 | QUESTION 69, RESPONSE 6 | 0,1 | |
| 148 | 1 | 192 | 192 | Q69RES07 | QUESTION 69, RESPONSE 7 | 0,1 | |
| 149 | 1 | 193 | 193 | Q70RES01 | QUESTION 70, RESPONSE 1 | 0,1 | |
| 150 | 1 | 194 | 194 | Q70RES02 | QUESTION 70, RESPONSE 2 | 0,1 | |
| 151 | 1 | 195 | 195 | Q70RES03 | QUESTION 70, RESPONSE 3 | 0,1 | |
| 152 | 1 | 196 | 196 | Q70RES04 | QUESTION 70, RESPONSE 4 | 0,1 | |
| 153 | 1 | 197 | 197 | Q70RES05 | QUESTION 70, RESPONSE 5 | 0,1 | |
| 154 | 1 | 198 | 198 | Q70RES06 | QUESTION 70, RESPONSE 6 | 0,1 | |
| 155 | 1 | 199 | 199 | Q70RES07 | QUESTION 70, RESPONSE 7 | 0,1 | |
| 156 | 1 | 200 | 200 | Q71 | QUESTION 71 | | A-G |
| 157 | 1 | 201 | 201 | Q72 | QUESTION 72 | | A-G |
| 158 | 1 | 202 | 202 | Q73 | QUESTION 73 | | A-F |
| 159 | 1 | 203 | 203 | Q74RES01 | QUESTION 74, RESPONSE 1 | 0,1 | |
| 160 | 1 | 204 | 204 | Q74RES02 | QUESTION 74, RESPONSE 2 | 0,1 | |
| 161 | 1 | 205 | 205 | Q74RES03 | QUESTION 74, RESPONSE 3 | 0,1 | |
| 162 | 1 | 206 | 206 | Q74RES04 | QUESTION 74, RESPONSE 4 | 0,1 | |
| 163 | 1 | 207 | 207 | Q74RES05 | QUESTION 74, RESPONSE 5 | 0,1 | |

| FLD# | NC | SC | EC | NAME | DESCRIPTION | RANGE | |
|---|---|---|---|---|---|---|---|
| 164 | 1 | 208 | 208 | Q74RES06 | QUESTION 74, RESPONSE 6 | 0,1 | |
| [illegible] | 1 | 209 | 209 | Q75 | QUESTION 75 | | A-F |
| 166 | 1 | 210 | 210 | Q76RES01 | QUESTION 76, RESPONSE 1 | 0,1 | |
| 167 | 1 | 211 | 211 | Q76RES02 | QUESTION 76, RESPONSE 2 | 0,1 | |
| 168 | 1 | 212 | 212 | Q76RES03 | QUESTION 76, RESPONSE 3 | 0,1 | |
| 169 | 1 | 213 | 213 | Q76RES04 | QUESTION 76, RESPONSE 4 | 0,1 | |
| 170 | 1 | 214 | 214 | Q76RES05 | QUESTION 76, RESPONSE 5 | 0,1 | |
| 171 | 1 | 215 | 215 | Q77 | QUESTION 77 | | A-D |
| 172 | 1 | 216 | 216 | Q78RES01 | QUESTION 78, RESPONSE 1 | 0,1 | |
| 173 | 1 | 217 | 217 | Q78RES02 | QUESTION 78, RESPONSE 2 | 0,1 | |
| 174 | 1 | 218 | 218 | Q78RES03 | QUESTION 78, RESPONSE 3 | 0,1 | |
| 175 | 1 | 219 | 219 | Q78RES04 | QUESTION 78, RESPONSE 4 | 0,1 | |
| 176 | 1 | 220 | 220 | Q78RES05 | QUESTION 78, RESPONSE 5 | 0,1 | |
| 177 | 1 | 221 | 221 | Q78RES06 | QUESTION 78, RESPONSE 6 | 0,1 | |
| 178 | 1 | 222 | 222 | Q78RES07 | QUESTION 78, RESPONSE 7 | 0,1 | |
| 179 | 1 | 223 | 223 | Q78RES08 | QUESTION 78, RESPONSE 8 | 0,1 | |
| 180 | 1 | 224 | 224 | Q79 | QUESTION 79 | | A-F |
| 181 | 1 | 225 | 225 | Q80RES01 | QUESTION 80, RESPONSE 1 | 0,1 | |
| 182 | 1 | 226 | 226 | Q80RES02 | QUESTION 80, RESPONSE 2 | 0,1 | |
| 183 | 1 | 227 | 227 | Q80RES03 | QUESTION 80, RESPONSE 3 | 0,1 | |
| 184 | 1 | 228 | 228 | Q80RES04 | QUESTION 80, RESPONSE 4 | 0,1 | |
| 185 | 1 | 229 | 229 | Q80RES05 | QUESTION 80, RESPONSE 5 | 0,1 | |
| 186 | 1 | 230 | 230 | Q80RES06 | QUESTION 80, RESPONSE 6 | 0,1 | |
| 187 | 1 | 231 | 231 | Q80RES07 | QUESTION 80, RESPONSE 7 | 0,1 | |
| 188 | 1 | 232 | 232 | Q81RES01 | QUESTION 81, RESPONSE 1 | 0,1 | |
| 189 | 1 | 233 | 233 | Q81RES02 | QUESTION 81, RESPONSE 2 | 0,1 | |
| 190 | 1 | 234 | 234 | Q81RES03 | QUESTION 81, RESPONSE 3 | 0,1 | |
| 191 | 1 | 235 | 235 | Q81RES04 | QUESTION 81, RESPONSE 4 | 0,1 | |
| 192 | 1 | 236 | 236 | Q81RES05 | QUESTION 81, RESPONSE 5 | 0,1 | |
| 193 | 1 | 237 | 237 | Q81RES06 | QUESTION 81, RESPONSE 6 | 0,1 | |
| 194 | 1 | 238 | 238 | Q81RES07 | QUESTION 81, RESPONSE 7 | 0,1 | |
| 195 | 1 | 239 | 239 | Q82RES01 | QUESTION 82, RESPONSE 1 | 0,1 | |
| 196 | 1 | 240 | 240 | Q82RES02 | QUESTION 82, RESPONSE 2 | 0,1 | |
| 197 | 1 | 241 | 241 | Q82RES03 | QUESTION 82, RESPONSE 3 | 0,1 | |
| 198 | 1 | 242 | 242 | Q82RES04 | QUESTION 82, RESPONSE 4 | 0,1 | |
| 199 | 1 | 243 | 243 | Q82RES05 | QUESTION 82, RESPONSE 5 | 0,1 | |
| 200 | 1 | 244 | 244 | Q82RES06 | QUESTION 82, RESPONSE 6 | 0,1 | |
| 201 | 1 | 245 | 245 | Q8[illegible]07 | QUESTION 82, RESPONSE 7 | 0,1 | |
| 202 | 1 | 246 | 246 | Q83R[illegible] | QUESTION 83, RESPONSE 1 | 0,1 | |
| 203 | 1 | 247 | 247 | Q83RES02 | QUESTION 83, RESPONSE 2 | 0,1 | |
| 204 | 1 | 248 | 248 | Q83RES03 | QUESTION 83, RESPONSE 3 | 0,1 | |
| 205 | 1 | 249 | 249 | Q83RES04 | QUESTION 83, RESPONSE 4 | 0,1 | |
| 206 | 1 | 250 | 250 | Q83RES05 | QUESTION 83, RESPONSE 5 | 0,1 | |
| 207 | 1 | 251 | 251 | Q83RES06 | QUESTION 83, RESPONSE 6 | 0,1 | |
| 208 | 1 | 252 | 252 | Q83RES07 | QUESTION 83, RESPONSE 7 | 0,1 | |
| 209 | 1 | 253 | 253 | Q84RES01 | QUESTION 84, RESPONSE 1 | 0,1 | |
| 210 | 1 | 254 | 254 | Q84RES02 | QUESTION 84, RESPONSE 2 | 0,1 | |
| 211 | 1 | 255 | 255 | Q84RES03 | QUESTION 84, RESPONSE 3 | 0,1 | |
| 212 | 1 | 256 | 256 | Q84RES04 | QUESTION 84, RESPONSE 4 | 0,1 | |
| 213 | 1 | 257 | 257 | Q84RES05 | QUESTION 84, RESPONSE 5 | 0,1 | |
| 214 | 1 | 258 | 258 | Q84RES06 | QUESTION 84, RESPONSE 6 | 0,1 | |
| 215 | 1 | 259 | 259 | Q84RES07 | QUESTION 84, RESPONSE 7 | 0,1 | |
| 216 | 1 | 260 | 260 | Q85RES01 | QUESTION 85, RESPONSE 1 | 0,1 | |
| 217 | 1 | 261 | 261 | Q85RES02 | QUESTION 85, RESPONSE 2 | 0,1 | |
| 218 | 1 | 262 | 262 | Q85RES03 | QUESTION 85, RESPONSE 3 | 0,1 | |

| FLD# | NC | SC | EC | NAME | DESCRIPTION | RANGE | |
|---|---|---|---|---|---|---|---|
| 219 | 1 | 263 | 263 | Q85RES04 | QUESTION 85, RESPONSE 4 | 0,1 | |
| 220 | 1 | 264 | 264 | Q85RES05 | QUESTION 85, RESPONSE 5 | 0,1 | |
| 221 | 1 | 265 | 265 | Q85RES06 | QUESTION 85, RESPONSE 6 | 0,1 | |
| 222 | 1 | 266 | 266 | Q85RES07 | QUESTION 85, RESPONSE 7 | 0,1 | |
| 223 | 1 | 267 | 267 | Q86RES01 | QUESTION 86, RESPONSE 1 | 0,1 | |
| 224 | 1 | 268 | 268 | Q86RES02 | QUESTION 86, RESPONSE 2 | 0,1 | |
| 225 | 1 | 269 | 269 | Q86RES03 | QUESTION 86, RESPONSE 3 | 0,1 | |
| 226 | 1 | 270 | 270 | Q86RES04 | QUESTION 86, RESPONSE 4 | 0,1 | |
| 227 | 1 | 271 | 271 | Q86RES05 | QUESTION 86, RESPONSE 5 | 0,1 | |
| 228 | 1 | 272 | 272 | Q86RES06 | QUESTION 86, RESPONSE 6 | 0,1 | |
| 229 | 1 | 273 | 273 | Q86RES07 | QUESTION 86, RESPONSE 7 | 0,1 | |
| 230 | 1 | 274 | 274 | Q87RES01 | QUESTION 87, RESPONSE 1 | 0,1 | |
| 231 | 1 | 275 | 275 | Q87RES02 | QUESTION 87, RESPONSE 2 | 0,1 | |
| 232 | 1 | 276 | 276 | Q87RES03 | QUESTION 87, RESPONSE 3 | 0,1 | |
| 233 | 1 | 277 | 277 | Q87RES04 | QUESTION 87, RESPONSE 4 | 0,1 | |
| 234 | 1 | 278 | 278 | Q87RES05 | QUESTION 87, RESPONSE 5 | 0,1 | |
| 235 | 1 | 279 | 279 | Q87RES06 | QUESTION 87, RESPONSE 6 | 0,1 | |
| 236 | 1 | 280 | 280 | Q87RES07 | QUESTION 87, RESPONSE 7 | 0,1 | |
| 237 | 1 | 281 | 281 | Q88 | QUESTION 88 | | A-D |
| 238 | 2 | 282 | 283 | MAJCOM | ASGT - CURRENT - MAJOR COMMAND ID | | A-Z |
| 239 | 6 | 284 | 289 | PAFSC | AFSC - PRIMARY - NUMBER/SUFFIX | 0-9, | A-C |
| 240 | 6 | 290 | 295 | DAFSC | AFSC - DUTY - NUMBER/SUFFIX | 0-9, | A-C |
| 241 | 17 | 296 | 312 | DTYLOC | ASGT - DUTY LOCATION NAME | | A-Z |
| 242 | 2 | 313 | 314 | GRADE | CURRENT GRADE | 0-9 | |

# Appendix D-3

# Trainee Survey Code Sheets

# VER0004X: SLT SURVEY FORM FOR RECIPIENTS OF TRAINING

| FLD# | NC | SC | EC | NAME | DESCRIPTION | RANGE | |
|---|---|---|---|---|---|---|---|
| 1 | 1 | 1 | 1 | LISTA | CODE FOR MAJOR COMMANDS,FIELD OPR. AGENCIES, ETC. | | A-Z |
| 2 | 10 | 2 | 11 | FILLER | FILLER | BLANKS | |
| 3 | 1 | 12 | 12 | LISTB | CODE FOR DESCRIPTION OF UNIT OF ASSIGNMENT | | A-Z |
| 4 | 14 | 13 | 26 | FILLER | FILLER | BLANKS | |
| 5 | 9 | 27 | 35 | SSAN | SOCIAL SECURITY ACCOUNT NUMBER | 0-9 | |
| 6 | 4 | 36 | 39 | VERSION | VERSION NUMBER | 0-9 | |
| 7 | 12 | 40 | 51 | FILLER | FILLER | BLANKS | |
| 8 | 1 | 52 | 52 | Q01 | QUESTION 1 | 1-6 | |
| 9 | 1 | 53 | 53 | Q02 | QUESTION 2 | | A-E |
| 10 | 1 | 54 | 54 | Q03 | QUESTION 3 | | A,B |
| 11 | 1 | 55 | 55 | Q04 | QUESTION 4 | | A-E |
| 12 | 1 | 56 | 56 | Q05 | QUESTION 5 | | A-G |
| 13 | 1 | 57 | 57 | Q06RES01 | QUESTION 6, RESPONSE 1 | 0,1 | |
| 14 | 1 | 58 | 58 | Q06RES02 | QUESTION 6, RESPONSE 2 | 0,1 | |
| 15 | 1 | 59 | 59 | Q06RES03 | QUESTION 6, RESPONSE 3 | 0,1 | |
| 16 | 1 | 60 | 60 | Q06RES04 | QUESTION 6, RESPONSE 4 | 0,1 | |
| 17 | 1 | 61 | 61 | Q06RES05 | QUESTION 6, RESPONSE 5 | 0,1 | |
| 18 | 1 | 62 | 62 | Q06RES06 | QUESTION 6, RESPONSE 6 | 0,1 | |
| 19 | 1 | 63 | 63 | Q06RES07 | QUESTION 6, RESPONSE 7 | 0,1 | |
| 20 | 1 | 64 | 64 | Q06RES08 | QUESTION 6, RESPONSE 8 | 0,1 | |
| 21 | 1 | 65 | 65 | Q06RES09 | QUESTION 6, RESPONSE 9 | 0,1 | |
| 22 | 1 | 66 | 66 | Q06RES10 | QUESTION 6, RESPONSE 10 | 0,1 | |
| 23 | 1 | 67 | 67 | Q07 | QUESTION 7 | 1-6 | |
| 24 | 1 | 68 | 68 | Q08 | QUESTION 8 | 1-6 | |
| 25 | 1 | 69 | 69 | Q09 | QUESTION 9 | 1-6 | |
| 26 | 1 | 70 | 70 | Q10 | QUESTION 10 | 1-6 | |
| 27 | 1 | 71 | 71 | Q11 | QUESTION 11 | 1-6 | |
| 28 | 1 | 72 | 72 | Q12 | QUESTION 12 | 1-6 | |
| 29 | 1 | 73 | 73 | Q13 | QUESTION 13 | 1-6 | |
| 30 | 1 | 74 | 74 | Q14 | QUESTION 14 | 1-6 | |
| 31 | 1 | 75 | 75 | Q15 | QUESTION 15 | 1-6 | |
| 32 | 1 | 76 | 76 | Q16 | QUESTION 16 | 1-6 | |
| 33 | 1 | 77 | 77 | Q17 | QUESTION 17 | 1-6 | |
| 34 | 1 | 78 | 78 | Q18 | QUESTION 18 | 1-6 | |
| 35 | 1 | 79 | 79 | Q19 | QUESTION 19 | 1-6 | |
| 36 | 1 | 80 | 80 | Q20 | QUESTION 20 | 1-6 | |
| 37 | 1 | 81 | 81 | Q21 | QUESTION 21 | 1-6 | |
| 38 | 1 | 82 | 82 | Q22 | QUESTION 22 | 1-6 | |
| 39 | 1 | 83 | 83 | Q23 | QUESTION 23 | 1-6 | |
| 40 | 1 | 84 | 84 | Q24 | QUESTION 24 | 1-6 | |
| 41 | 1 | 85 | 85 | Q25 | QUESTION 25 | 1-6 | |
| 42 | 1 | 86 | 86 | Q26 | QUESTION 26 | | A-D |
| 43 | 1 | 87 | 87 | Q27 | QUESTION 27 | | A-C |
| 44 | 1 | 88 | 88 | Q28 | QUESTION 28 | | A-E |
| 45 | 1 | 89 | 89 | Q29RES01 | QUESTION 29, RESPONSE 1 | 0,1 | |
| 46 | 1 | 90 | 90 | Q29RES02 | QUESTION 29, RESPONSE 2 | 0,1 | |
| 47 | 1 | 91 | 91 | Q29RES03 | QUESTION 29, RESPONSE 3 | 0,1 | |
| 48 | 1 | 92 | 92 | Q29RES04 | QUESTION 29, RESPONSE 4 | 0,1 | |
| 49 | 1 | 93 | 93 | Q29RES05 | QUESTION 29, RESPONSE 5 | 0,1 | |
| 50 | 1 | 94 | 94 | Q29RES06 | QUESTION 29, RESPONSE 6 | 0,1 | |
| 51 | 1 | 95 | 95 | Q30 | QUESTION 30 | | A-E |
| 52 | 1 | 96 | 96 | Q31 | QUESTION 31 | | A-F |
| 53 | 1 | 97 | 97 | Q32 | QUESTION 32 | | A-C |

| FLD# | NC | SC | EC | NAME | DESCRIPTION | RANGE |
|---|---|---|---|---|---|---|
| 54 | 1 | 98 | 98 | Q33 | QUESTION 33 | 1-5 |
| 55 | 1 | 99 | 99 | Q34 | QUESTION 34 | 1-5 |
| 56 | 1 | 100 | 100 | Q35 | QUESTION 35 | 1-5 |
| 57 | 1 | 101 | 101 | Q36RES01 | QUESTION 36, RESPONSE 1 | 0,1 |
| 58 | 1 | 102 | 102 | Q36RES02 | QUESTION 36, RESPONSE 2 | 0,1 |
| 59 | 1 | 103 | 103 | Q36RES03 | QUESTION 36, RESPONSE 3 | 0,1 |
| 60 | 1 | 104 | 104 | Q36RES04 | QUESTION 36, RESPONSE 4 | 0,1 |
| 61 | 1 | 105 | 105 | Q36RES05 | QUESTION 36, RESPONSE 5 | 0,1 |
| 62 | 1 | 106 | 106 | Q36RES06 | QUESTION 36, RESPONSE 6 | 0,1 |
| 63 | 1 | 107 | 107 | Q36RES07 | QUESTION 36, RESPONSE 7 | 0,1 |
| 64 | 1 | 108 | 108 | Q36RES08 | QUESTION 36, RESPONSE 8 | 0,1 |
| 65 | 1 | 109 | 109 | Q36RES09 | QUESTION 36, RESPONSE 9 | 0,1 |
| 66 | 1 | 110 | 110 | Q37RES01 | QUESTION 37, RESPONSE 1 | 0,1 |
| 67 | 1 | 111 | 111 | Q37RES02 | QUESTION 37, RESPONSE 2 | 0,1 |
| 68 | 1 | 112 | 112 | Q37RES03 | QUESTION 37, RESPONSE 3 | 0,1 |
| 69 | 1 | 113 | 113 | Q37RES04 | QUESTION 37, RESPONSE 4 | 0,1 |
| 70 | 1 | 114 | 114 | Q37RES05 | QUESTION 37, RESPONSE 5 | 0,1 |
| 71 | 1 | 115 | 115 | Q37RES06 | QUESTION 37, RESPONSE 6 | 0,1 |
| 72 | 1 | 116 | 116 | Q37RES07 | QUESTION 37, RESPONSE 7 | 0,1 |
| 73 | 1 | 117 | 117 | Q37RES08 | QUESTION 37, RESPONSE 8 | 0,1 |
| 74 | 1 | 118 | 118 | Q37RES09 | QUESTION 37, RESPONSE 9 | 0,1 |
| 75 | 1 | 119 | 119 | Q38RES01 | QUESTION 38, RESPONSE 1 | 0,1 |
| 76 | 1 | 120 | 120 | Q38RES02 | QUESTION 38, RESPONSE 2 | 0,1 |
| 77 | 1 | 121 | 121 | Q38RES03 | QUESTION 38, RESPONSE 3 | 0,1 |
| 78 | 1 | 122 | 122 | Q38RES04 | QUESTION 38, RESPONSE 4 | 0,1 |
| 79 | 1 | 123 | 123 | Q38RES05 | QUESTION 38, RESPONSE 5 | 0,1 |
| 80 | 1 | 124 | 124 | Q38RES06 | QUESTION 38, RESPONSE 6 | 0,1 |
| 81 | 1 | 125 | 125 | Q38RES07 | QUESTION 38, RESPONSE 7 | 0,1 |
| 82 | 1 | 126 | 126 | Q38RES08 | QUESTION 38, RESPONSE 8 | 0,1 |
| 83 | 1 | 127 | 127 | Q38RES09 | QUESTION 38, RESPONSE 9 | 0,1 |
| 84 | 1 | 128 | 128 | Q39RES01 | QUESTION 39, RESPONSE 1 | 0,1 |
| 85 | 1 | 129 | 129 | Q39RES02 | QUESTION 39, RESPONSE 2 | 0,1 |
| 86 | 1 | 130 | 130 | Q39RES03 | QUESTION 39, RESPONSE 3 | 0,1 |
| 87 | 1 | 131 | 131 | Q39RES04 | QUESTION 39, RESPONSE 4 | 0,1 |
| 88 | 1 | 132 | 132 | Q39RES05 | QUESTION 39, RESPONSE 5 | 0,1 |
| 89 | 1 | 133 | 133 | Q39RES06 | QUESTION 39, RESPONSE 6 | 0,1 |
| 90 | 1 | 134 | 134 | Q39RES07 | QUESTION 39, RESPONSE 7 | 0,1 |
| 91 | 1 | 135 | 135 | Q39RES08 | QUESTION 39, RESPONSE 8 | 0,1 |
| 92 | 1 | 136 | 136 | Q39RES09 | QUESTION 39, RESPONSE 9 | 0,1 |
| 93 | 1 | 137 | 137 | Q40RES01 | QUESTION 40, RESPONSE 1 | 0,1 |
| 94 | 1 | 138 | 138 | Q40RES02 | QUESTION 40, RESPONSE 2 | 0,1 |
| 95 | 1 | 139 | 139 | Q40RES03 | QUESTION 40, RESPONSE 3 | 0,1 |
| 96 | 1 | 140 | 140 | Q40RES04 | QUESTION 40, RESPONSE 4 | 0,1 |
| 97 | 1 | 141 | 141 | Q40RES05 | QUESTION 40, RESPONSE 5 | 0,1 |
| 98 | 1 | 142 | 142 | Q40RES06 | QUESTION 40, RESPONSE 6 | 0,1 |
| 99 | 1 | 143 | 143 | Q40RES07 | QUESTION 40, RESPONSE 7 | 0,1 |
| 100 | 1 | 144 | 144 | Q40RES08 | QUESTION 40, RESPONSE 8 | 0,1 |
| 101 | 1 | 145 | 145 | Q40RES09 | QUESTION 40, RESPONSE 9 | 0,1 |
| 102 | 1 | 146 | 146 | Q41RES01 | QUESTION 41, RESPONSE 1 | 0,1 |
| 103 | 1 | 147 | 147 | Q41RES02 | QUESTION 41, RESPONSE 2 | 0,1 |
| 104 | 1 | 148 | 148 | Q41RES03 | QUESTION 41, RESPONSE 3 | 0,1 |
| 105 | 1 | 149 | 149 | Q41RES04 | QUESTION 41, RESPONSE 4 | 0,1 |
| 106 | 1 | 150 | 150 | Q41RES05 | QUESTION 41, RESPONSE 5 | 0,1 |
| 107 | 1 | 151 | 151 | Q41RES06 | QUESTION 41, RESPONSE 6 | 0,1 |
| 108 | 1 | 152 | 152 | Q41RES07 | QUESTION 41, RESPONSE 7 | 0,1 |

| FLD# | NC | SC | EC | NAME | DESCRIPTION | RANGE |
|---|---|---|---|---|---|---|
| 109 | 1 | 153 | 153 | Q41RES08 | QUESTION 41, RESPONSE 8 | 0,1 |
| 110 | 1 | 154 | 154 | Q41RES09 | QUESTION 41, RESPONSE 9 | 0,1 |
| 111 | 1 | 155 | 155 | Q42RES01 | QUESTION 42, RESPONSE 1 | 0,1 |
| 112 | 1 | 156 | 156 | Q42RES02 | QUESTION 42, RESPONSE 2 | 0,1 |
| 113 | 1 | 157 | 157 | Q42RES03 | QUESTION 42, RESPONSE 3 | 0,1 |
| 114 | 1 | 158 | 158 | Q42RES04 | QUESTION 42, RESPONSE 4 | 0,1 |
| 115 | 1 | 159 | 159 | Q42RES05 | QUESTION 42, RESPONSE 5 | 0,1 |
| 116 | 1 | 160 | 160 | Q42RES06 | QUESTION 42, RESPONSE 6 | 0,1 |
| 117 | 1 | 161 | 161 | Q42RES07 | QUESTION 42, RESPONSE 7 | 0,1 |
| 118 | 1 | 162 | 162 | Q42RES08 | QUESTION 42, RESPONSE 8 | 0,1 |
| 119 | 1 | 163 | 163 | Q42RES09 | QUESTION 42, RESPONSE 9 | 0,1 |
| 120 | 1 | 164 | 164 | Q43RES01 | QUESTION 43, RESPONSE 1 | 0,1 |
| 121 | 1 | 165 | 165 | Q43RES02 | QUESTION 43, RESPONSE 2 | 0,1 |
| 122 | 1 | 166 | 166 | Q43RES03 | QUESTION 43, RESPONSE 3 | 0,1 |
| 123 | 1 | 167 | 167 | Q43RES04 | QUESTION 43, RESPONSE 4 | 0,1 |
| 124 | 1 | 168 | 168 | Q43RES05 | QUESTION 43, RESPONSE 5 | 0,1 |
| 125 | 1 | 169 | 169 | Q43RES06 | QUESTION 43, RESPONSE 6 | 0,1 |
| 126 | 1 | 170 | 170 | Q43RES07 | QUESTION 43, RESPONSE 7 | 0,1 |
| 127 | 1 | 171 | 171 | Q43RES08 | QUESTION 43, RESPONSE 8 | 0,1 |
| 128 | 1 | 172 | 172 | Q43RES09 | QUESTION 43, RESPONSE 9 | 0,1 |
| 129 | 1 | 173 | 173 | Q44RES01 | QUESTION 44, RESPONSE 1 | 0,1 |
| 130 | 1 | 174 | 174 | Q44RES02 | QUESTION 44, RESPONSE 2 | 0,1 |
| 131 | 1 | 175 | 175 | Q44RES03 | QUESTION 44, RESPONSE 3 | 0,1 |
| 132 | 1 | 176 | 176 | Q44RES04 | QUESTION 44, RESPONSE 4 | 0,1 |
| 133 | 1 | 177 | 177 | Q44RES05 | QUESTION 44, RESPONSE 5 | 0,1 |
| 134 | 1 | 178 | 178 | Q44RES06 | QUESTION 44, RESPONSE 6 | 0,1 |
| 135 | 1 | 179 | 179 | Q44RES07 | QUESTION 44, RESPONSE 7 | 0,1 |
| 136 | 1 | 180 | 180 | Q44RES08 | QUESTION 44, RESPONSE 8 | 0,1 |
| 137 | 1 | 181 | 181 | Q44RES09 | QUESTION 44, RESPONSE 9 | 0,1 |
| 138 | 1 | 182 | 182 | Q45RES01 | QUESTION 45, RESPONSE 1 | 0,1 |
| 139 | 1 | 183 | 183 | Q45RES02 | QUESTION 45, RESPONSE 2 | 0,1 |
| 140 | 1 | 184 | 184 | Q45RES03 | QUESTION 45, RESPONSE 3 | 0,1 |
| 141 | 1 | 185 | 185 | Q45RES04 | QUESTION 45, RESPONSE 4 | 0,1 |
| 142 | 1 | 186 | 186 | Q45RES05 | QUESTION 45, RESPONSE 5 | 0,1 |
| 143 | 1 | 187 | 187 | Q45RES06 | QUESTION 45, RESPONSE 6 | 0,1 |
| 144 | 1 | 188 | 188 | Q45RES07 | QUESTION 45, RESPONSE 7 | 0,1 |
| 145 | 1 | 189 | 189 | Q45RES08 | QUESTION 45, RESPONSE 8 | 0,1 |
| 146 | 1 | 190 | 190 | Q45RES09 | QUESTION 45, RESPONSE 9 | 0,1 |
| 147 | 1 | 191 | 191 | Q46RES01 | QUESTION 46, RESPONSE 1 | 0,1 |
| 148 | 1 | 192 | 192 | Q46RES02 | QUESTION 46, RESPONSE 2 | 0,1 |
| 149 | 1 | 193 | 193 | Q46RES03 | QUESTION 46, RESPONSE 3 | 0,1 |
| 150 | 1 | 194 | 194 | Q46RES04 | QUESTION 46, RESPONSE 4 | 0,1 |
| 151 | 1 | 195 | 195 | Q46RES05 | QUESTION 46, RESPONSE 5 | 0,1 |
| 152 | 1 | 196 | 196 | Q46RES06 | QUESTION 46, RESPONSE 6 | 0,1 |
| 153 | 1 | 197 | 197 | Q46RES07 | QUESTION 46, RESPONSE 7 | 0,1 |
| 154 | 1 | 198 | 198 | Q46RES08 | QUESTION 46, RESPONSE 8 | 0,1 |
| 155 | 1 | 199 | 199 | Q46RES09 | QUESTION 46, RESPONSE 9 | 0,1 |
| 156 | 1 | 200 | 200 | Q47RES01 | QUESTION 47, RESPONSE 1 | 0,1 |
| 157 | 1 | 201 | 201 | Q47RES02 | QUESTION 47, RESPONSE 2 | 0,1 |
| 158 | 1 | 202 | 202 | Q47RES03 | QUESTION 47, RESPONSE 3 | 0,1 |
| 159 | 1 | 203 | 203 | Q47RES04 | QUESTION 47, RESPONSE 4 | 0,1 |
| 160 | 1 | 204 | 204 | Q47RES05 | QUESTION 47, RESPONSE 5 | 0,1 |
| 161 | 1 | 205 | 205 | Q47RES06 | QUESTION 47, RESPONSE 6 | 0,1 |
| 162 | 1 | 206 | 206 | Q47RES07 | QUESTION 47, RESPONSE 7 | 0,1 |
| 163 | 1 | 207 | 207 | Q47RES08 | QUESTION 47, RESPONSE 8 | 0,1 |

| FLD# | NC | SC | EC | NAME | DESCRIPTION | RANGE | |
|---|---|---|---|---|---|---|---|
| 164 | 1 | 208 | 208 | Q47RES09 | QUESTION 47, RESPONSE 9 | 0,1 | |
| 165 | 1 | 209 | 209 | Q48 | QUESTION 48 | | A-E |
| 166 | 1 | 210 | 210 | Q49 | QUESTION 49 | | A-D |
| 167 | 1 | 211 | 211 | Q50RES01 | QUESTION 50, RESPONSE 1 | 0,1 | |
| 168 | 1 | 212 | 212 | Q50RES02 | QUESTION 50, RESPONSE 2 | 0,1 | |
| 169 | 1 | 213 | 213 | Q50RES03 | QUESTION 50, RESPONSE 3 | 0,1 | |
| 170 | 1 | 214 | 214 | Q50RES04 | QUESTION 50, RESPONSE 4 | 0,1 | |
| 171 | 1 | 215 | 215 | Q50RES05 | QUESTION 50, RESPONSE 5 | 0,1 | |
| 172 | 1 | 216 | 216 | Q50RES06 | QUESTION 50, RESPONSE 6 | 0,1 | |
| 173 | 1 | 217 | 217 | Q50RES07 | QUESTION 50, RESPONSE 7 | 0,1 | |
| 174 | 1 | 218 | 218 | Q51 | QUESTION 51 | 1-5 | |
| 175 | 1 | 219 | 219 | Q52 | QUESTION 52 | 1-4 | |
| 176 | 2 | 220 | 221 | MAJCOM | ASGT - CURRENT - MAJOR COMMAND ID | | A-Z |
| 177 | 6 | 222 | 227 | PAFSC | AFSC - PRIMARY - NUMBER/SUFFIX | 0-9, | A-C |
| 178 | 6 | 228 | 233 | DAFSC | AFSC - DUTY - NUMBER/SUFFIX | 0-9, | A-C |
| 179 | 17 | 234 | 250 | DTYLOC | ASGT - DUTY LOCATION NAME | | A-Z |
| 180 | 2 | 251 | 252 | GRADE | CURRENT GRADE | 0-9 | |

# Appendix D-4

# Training Manager Interview Code Sheets

## STRUCTURE OF MANAGER DATA

| FLD# | Field Name | Type | NC |
|---|---|---|---|
| 1 | REC_NO | Numeric | 3 |
| 2 | CE111 | Numeric | 1 |
| 3 | MAINT112 | Numeric | 1 |
| 4 | MED113 | Numeric | 1 |
| 5 | MS114 | Numeric | 1 |
| 6 | PERS115 | Numeric | 1 |
| 7 | SP116 | Numeric | 1 |
| 8 | SUP117 | Numeric | 1 |
| 9 | TRANS118 | Numeric | 1 |
| 10 | MAC121 | Numeric | 1 |
| 11 | SAC122 | Numeric | 1 |
| 12 | TAC123 | Numeric | 1 |
| 13 | AFSC13 | Character | 7 |
| 14 | PAFSC131 | Character | 7 |
| 15 | 75XXX132 | Numeric | 4 |
| 16 | TIS14 | Numeric | 4 |
| 17 | PRI161 | Numeric | 1 |
| 18 | ADD162 | Numeric | 1 |
| 19 | MEASTM17 | Numeric | 4 |
| 20 | NO181 | Numeric | 1 |
| 21 | YES182 | Numeric | 1 |
| 22 | NO191 | Numeric | 1 |
| 23 | YES192 | Numeric | 1 |
| 24 | LC1921 | Numeric | 1 |
| 25 | NRH1922 | Numeric | 1 |
| 26 | DIM1923 | Numeric | 1 |
| 27 | ENH1924 | Numeric | 1 |
| 28 | FLEX1925 | Numeric | 1 |
| 29 | CMS1101 | Numeric | 1 |
| 30 | SMS1102 | Numeric | 1 |
| 31 | MSG1103 | Numeric | 1 |
| 32 | TSG1104 | Numeric | 1 |
| 33 | SSG1105 | Numeric | 1 |
| 34 | SGT1106 | Numeric | 1 |
| 35 | RAMN1107 | Numeric | 1 |
| 36 | A1C1108 | Numeric | 1 |
| 37 | AMN1109 | Numeric | 1 |
| 38 | NBA11010 | Numeric | 1 |

| FLD# | Field Name | Type | NC |
|---|---|---|---|
| 39 | CIV11011 | Numeric | 1 |
| 40 | POPE1111 | Numeric | 1 |
| 41 | LANG1112 | Numeric | 1 |
| 42 | OFF1113 | Numeric | 1 |
| 43 | COTT1114 | Numeric | 1 |
| 44 | CCON1115 | Numeric | 1 |
| 45 | LLIS1116 | Numeric | 1 |
| 46 | NO211 | Numeric | 1 |
| 47 | YES212 | Numeric | 1 |
| 48 | TY221 | Numeric | 1 |
| 49 | EM222 | Numeric | 1 |
| 50 | OY223 | Numeric | 1 |
| 51 | SM224 | Numeric | 1 |
| 52 | TM225 | Numeric | 1 |
| 53 | LTTM2226 | Numeric | 1 |
| 54 | PORE231 | Numeric | 1 |
| 55 | MEC232 | Numeric | 1 |
| 56 | TTP233 | Numeric | 1 |
| 57 | FTD234 | Numeric | 1 |
| 58 | COMP235 | Numeric | 1 |
| 59 | EVALS236 | Numeric | 1 |
| 60 | INC241 | Numeric | 1 |
| 61 | DEC242 | Numeric | 1 |
| 62 | SAME243 | Numeric | 1 |
| 63 | ENTRY251 | Numeric | 1 |
| 64 | EQUIP252 | Numeric | 1 |
| 65 | NCMAN253 | Numeric | 1 |
| 66 | ECMAN254 | Numeric | 1 |
| 67 | DECTR255 | Numeric | 1 |
| 68 | INCTR256 | Numeric | 1 |
| 69 | NCMIS257 | Numeric | 1 |
| 70 | ECMIS258 | Numeric | 1 |
| 71 | STDS259 | Numeric | 1 |
| 72 | EMPH2510 | Numeric | 1 |
| 73 | NSOL2511 | Numeric | 1 |
| 74 | YES261 | Numeric | 1 |
| 75 | CTR26111 | Numeric | 1 |
| 76 | IMP26112 | Numeric | 1 |
| 77 | NO262 | Numeric | 1 |
| 78 | CTR26211 | Numeric | 1 |
| 79 | IMP26212 | Numeric | 1 |
| 80 | NO271 | Numeric | 1 |

| FLD# | Field Name | Type | NC |
|---|---|---|---|
| 81 | YES272 | Numeric | 1 |
| 82 | ASS27211 | Numeric | 1 |
| 83 | OJT27212 | Numeric | 1 |
| 84 | NTR27213 | Numeric | 1 |
| 85 | NO311 | Numeric | 1 |
| 86 | YES312 | Numeric | 1 |
| 87 | MAN321 | Numeric | 1 |
| 88 | AUTO322 | Numeric | 1 |
| 89 | IMS32211 | Numeric | 1 |
| 90 | AMS32212 | Numeric | 1 |
| 91 | PAS32213 | Numeric | 1 |
| 92 | ANG32214 | Numeric | 1 |
| 93 | CAL32221 | Numeric | 1 |
| 94 | EED32231 | Numeric | 1 |
| 95 | CUR32232 | Numeric | 1 |
| 96 | ANG32233 | Numeric | 1 |
| 97 | EFF32234 | Numeric | 1 |
| 98 | ONE32236 | Numeric | 1 |
| 99 | OMP32241 | Numeric | 1 |
| 100 | UMB32242 | Numeric | 1 |
| 101 | OST32243 | Numeric | 1 |
| 102 | FLX32244 | Numeric | 1 |
| 103 | ONE32246 | Numeric | 1 |
| 104 | UMD331 | Numeric | 1 |
| 105 | ATT332 | Numeric | 1 |
| 106 | LMC333 | Numeric | 1 |
| 107 | LCST334 | Numeric | 1 |
| 108 | LASS335 | Numeric | 1 |
| 109 | SHOWS336 | Numeric | 1 |
| 110 | ETA337 | Numeric | 1 |
| 111 | GTTG338 | Numeric | 1 |
| 112 | FTDAV339 | Numeric | 1 |
| 113 | NFSC3310 | Numeric | 1 |
| 114 | NONE3312 | Numeric | 1 |
| 115 | REC_NO | Numeric | 3 |
| 116 | CBT411 | Numeric | 1 |
| 117 | IVD412 | Numeric | 1 |
| 118 | VIDEO413 | Numeric | 1 |
| 119 | CLSRM414 | Numeric | 1 |
| 120 | SELF415 | Numeric | 1 |
| 121 | SIM416 | Numeric | 1 |
| 122 | EQUIP417 | Numeric | 1 |

| FLD# | Field Name | Type | NC |
|---|---|---|---|
| 123 | NOPEQ418 | Numeric | 1 |
| 124 | AVMON421 | Character | 9 |
| 125 | VTIME422 | Character | 9 |
| 126 | SSINS423 | Character | 9 |
| 127 | EDBCK424 | Character | 9 |
| 128 | NDSON425 | Character | 9 |
| 129 | ISRUP426 | Character | 9 |
| 130 | REAL427 | Character | 9 |
| 131 | NONE429 | Numeric | 1 |
| 132 | COST431 | Character | 9 |
| 133 | WASTE432 | Character | 9 |
| 134 | REINS433 | Character | 9 |
| 135 | OFEED434 | Character | 9 |
| 136 | HNDON435 | Character | 9 |
| 137 | ISRUP436 | Character | 9 |
| 138 | OREAL437 | Character | 9 |
| 139 | TDATE438 | Character | 9 |
| 140 | OTIME439 | Character | 9 |
| 141 | RING4310 | Character | 9 |
| 142 | NONE4312 | Numeric | 1 |
| 143 | NO441 | Numeric | 1 |
| 144 | YES442 | Numeric | 1 |
| 145 | RBBM451 | Numeric | 1 |
| 146 | XPENS452 | Numeric | 1 |
| 147 | WTIME453 | Numeric | 1 |
| 148 | EQOBS454 | Numeric | 1 |
| 149 | NO511 | Numeric | 1 |
| 150 | YES512 | Numeric | 1 |
| 151 | FIFTY521 | Numeric | 1 |
| 152 | TFTF522 | Numeric | 1 |
| 153 | TTTF523 | Numeric | 1 |
| 154 | LTEN524 | Numeric | 1 |
| 155 | NO531 | Numeric | 1 |
| 156 | YES532 | Numeric | 1 |
| 157 | ISD541 | Numeric | 1 |
| 158 | AUTO542 | Numeric | 1 |
| 159 | NA551 | Numeric | 1 |
| 160 | OTFAM552 | Numeric | 1 |
| 161 | MPLEX553 | Numeric | 1 |
| 162 | UMBER554 | Numeric | 1 |
| 163 | NA555 | Numeric | 1 |
| 164 | MECON556 | Numeric | 1 |

| FLD# | Field Name | Type | NC |
|---|---|---|---|
| 165 | OSTLY557 | Numeric | 1 |
| 166 | REGS561 | Numeric | 1 |
| 167 | CDC562 | Numeric | 1 |
| 168 | ISD563 | Numeric | 1 |
| 169 | SME564 | Numeric | 1 |
| 170 | REGS571 | Numeric | 1 |
| 171 | CDC572 | Numeric | 1 |
| 172 | ISD573 | Numeric | 1 |
| 173 | SME574 | Numeric | 1 |
| 174 | BTS575 | Numeric | 1 |
| 175 | CONT576 | Numeric | 1 |
| 176 | FTD577 | Numeric | 1 |
| 177 | NO611 | Numeric | 1 |
| 178 | YES612 | Numeric | 1 |
| 179 | MAN6121 | Numeric | 1 |
| 180 | AUTO6122 | Numeric | 1 |
| 181 | CAL61221 | Numeric | 1 |
| 182 | PAPER621 | Numeric | 1 |
| 183 | TIME622 | Numeric | 1 |
| 184 | UMBER623 | Numeric | 1 |
| 185 | STAND624 | Numeric | 1 |
| 186 | VALUE625 | Numeric | 1 |
| 187 | AUTO626 | Numeric | 1 |
| 188 | RRENT627 | Numeric | 1 |
| 189 | SGUID628 | Numeric | 1 |
| 190 | NONE6210 | Numeric | 1 |
| 191 | NO711 | Numeric | 1 |
| 192 | YES712 | Numeric | 1 |
| 193 | OTS721 | Numeric | 1 |
| 194 | QUEST722 | Numeric | 1 |
| 195 | NTSUP723 | Numeric | 1 |
| 196 | EXAMS724 | Numeric | 1 |
| 197 | SKEVA725 | Numeric | 1 |
| 198 | SME726 | Numeric | 1 |
| 199 | DNK728 | Numeric | 1 |
| 200 | NO731 | Numeric | 1 |
| 201 | YES732 | Numeric | 1 |
| 202 | CBT73211 | Numeric | 1 |
| 203 | CAL73221 | Numeric | 1 |
| 204 | NO811 | Numeric | 1 |
| 205 | YES812 | Numeric | 1 |
| 206 | NFORM821 | Numeric | 1 |

| FLD# | Field Name | Type | NC |
|---|---|---|---|
| 207 | RMALA822 | Numeric | 1 |
| 208 | RMALS823 | Numeric | 1 |
| 209 | IANN8231 | Numeric | 1 |
| 210 | UART8232 | Numeric | 1 |
| 211 | ONTH8233 | Numeric | 1 |
| 212 | WEEK8234 | Numeric | 1 |
| 213 | AILY8235 | Numeric | 1 |
| 214 | NO831 | Numeric | 1 |
| 215 | YES832 | Numeric | 1 |
| 216 | ARE83211 | Numeric | 1 |
| 217 | ARN83212 | Numeric | 1 |
| 218 | LVE83213 | Numeric | 1 |
| 219 | ORD83214 | Numeric | 1 |
| 220 | INF83215 | Numeric | 1 |
| 221 | REC_NO | Numeric | 3 |
| 222 | YES911 | Numeric | 1 |
| 223 | EP9111 | Numeric | 1 |
| 224 | IFTY9112 | Numeric | 1 |
| 225 | TT9113 | Numeric | 1 |
| 226 | IRTY9114 | Numeric | 1 |
| 227 | F9115 | Numeric | 1 |
| 228 | ENTY9116 | Numeric | 1 |
| 229 | FTEN9117 | Numeric | 1 |
| 230 | TEN9118 | Numeric | 1 |
| 231 | UNK9119 | Numeric | 1 |
| 232 | NO912 | Numeric | 1 |
| 233 | ISSUF921 | Numeric | 1 |
| 234 | MANPR922 | Numeric | 1 |
| 235 | QUAL923 | Numeric | 1 |
| 236 | WAYSB924 | Numeric | 1 |
| 237 | EWAYT925 | Numeric | 1 |
| 238 | ALIMP926 | Numeric | 1 |
| 239 | AILOR927 | Numeric | 1 |
| 240 | OFART928 | Numeric | 1 |
| 241 | DNK1031 | Numeric | 1 |
| 242 | YES1032 | Numeric | 1 |
| 243 | CBT10321 | Numeric | 1 |
| 244 | IVD10322 | Numeric | 1 |
| 245 | NO1041 | Numeric | 1 |
| 246 | YES1111 | Numeric | 1 |
| 247 | NO1112 | Numeric | 1 |

# Appendix D-5

## Trainer Interview Code Sheets

| FLD# | Field Name | Type | NC |
|---|---|---|---|
| 87 | SGT1196 | Numeric | 1 |
| 88 | RAMN1197 | Numeric | 1 |
| 89 | A1C1198 | Numeric | 1 |
| 90 | AMN1199 | Numeric | 1 |
| 91 | NBA11910 | Numeric | 1 |
| 92 | CIV11911 | Numeric | 1 |
| 93 | POPE1201 | Numeric | 1 |
| 94 | LANG1202 | Numeric | 1 |
| 95 | OFF1203 | Numeric | 1 |
| 96 | COTT1204 | Numeric | 1 |
| 97 | CCON1205 | Numeric | 1 |
| 98 | LLIS1206 | Numeric | 1 |
| 99 | REC_NO | Numeric | 3 |
| 100 | NO211 | Numeric | 1 |
| 101 | YES212 | Numeric | 1 |
| 102 | SIXMO221 | Numeric | 1 |
| 103 | ONEYR222 | Numeric | 1 |
| 104 | EMO223 | Numeric | 1 |
| 105 | TWOYR224 | Numeric | 1 |
| 106 | NO231 | Numeric | 1 |
| 107 | YES232 | Numeric | 1 |
| 108 | UTO23211 | Numeric | 1 |
| 109 | MAN23212 | Numeric | 1 |
| 110 | ILL23221 | Numeric | 1 |
| 111 | NGN23222 | Numeric | 1 |
| 112 | UIP23223 | Numeric | 1 |
| 113 | ONT23231 | Numeric | 1 |
| 114 | NTH23232 | Numeric | 1 |
| 115 | ART23233 | Numeric | 1 |
| 116 | ANN23234 | Numeric | 1 |
| 117 | UAL23235 | Numeric | 1 |
| 118 | SND23236 | Numeric | 1 |
| 119 | NO23241 | Numeric | 1 |
| 120 | YES23242 | Numeric | 1 |
| 121 | TEC23251 | Numeric | 1 |
| 122 | TDC23252 | Numeric | 1 |
| 123 | NO311 | Numeric | 1 |
| 124 | YES312 | Numeric | 1 |
| 125 | YEAR321 | Numeric | 1 |
| 126 | EMOS322 | Numeric | 1 |
| 127 | SMOS323 | Numeric | 1 |
| 128 | FMOS324 | Numeric | 1 |
| 129 | THMOS325 | Numeric | 1 |
| 130 | WOMOS326 | Numeric | 1 |
| 131 | ONEMO327 | Numeric | 1 |

| FLD# | Field Name | Type | NC |
|---|---|---|---|
| 132 | UNK328 | Numeric | 1 |
| 133 | MPR331 | Numeric | 1 |
| 134 | TYSCH332 | Numeric | 1 |
| 135 | INC341 | Numeric | 1 |
| 136 | DEC342 | Numeric | 1 |
| 137 | SAME343 | Numeric | 1 |
| 138 | TPERS351 | Numeric | 1 |
| 139 | EQUIP352 | Numeric | 1 |
| 140 | NCMAN353 | Numeric | 1 |
| 141 | ECMAN354 | Numeric | 1 |
| 142 | DECTR355 | Numeric | 1 |
| 143 | INCTR356 | Numeric | 1 |
| 144 | CMISS357 | Numeric | 1 |
| 145 | CMISS358 | Numeric | 1 |
| 146 | VSTDS359 | Numeric | 1 |
| 147 | DEMP3510 | Numeric | 1 |
| 148 | SMER3511 | Numeric | 1 |
| 149 | LCH3512 | Numeric | 1 |
| 150 | YES361 | Numeric | 1 |
| 151 | CTR36111 | Numeric | 1 |
| 152 | ONE36112 | Numeric | 1 |
| 153 | NO362 | Numeric | 1 |
| 154 | CTR36211 | Numeric | 1 |
| 155 | TNO36212 | Numeric | 1 |
| 156 | NO371 | Numeric | 1 |
| 157 | YES372 | Numeric | 1 |
| 158 | REP37211 | Numeric | 1 |
| 159 | ELF37212 | Numeric | 1 |
| 160 | NO411 | Numeric | 1 |
| 161 | YES412 | Numeric | 1 |
| 162 | MAN421 | Numeric | 1 |
| 163 | AUTO422 | Numeric | 1 |
| 164 | CAL42211 | Numeric | 1 |
| 165 | EED42221 | Numeric | 1 |
| 166 | ACC42222 | Numeric | 1 |
| 167 | ANG42223 | Numeric | 1 |
| 168 | EFF42224 | Numeric | 1 |
| 169 | NE42226 | Numeric | 1 |
| 170 | MP42231 | Numeric | 1 |
| 171 | MB42232 | Numeric | 1 |
| 172 | ST42233 | Numeric | 1 |
| 173 | LX42234 | Numeric | 1 |
| 174 | NE42236 | Numeric | 1 |
| 175 | UMD431 | Numeric | 1 |

| FLD# | Field Name | Type | NC |
|---|---|---|---|
| 176 | ATT432 | Numeric | 1 |
| 177 | LMC433 | Numeric | 1 |
| 178 | LCS434 | Numeric | 1 |
| 179 | LASS435 | Numeric | 1 |
| 180 | TYINT436 | Numeric | 1 |
| 181 | OTIME437 | Numeric | 1 |
| 182 | NONE439 | Numeric | 1 |
| 183 | REC_NO | Numeric | 3 |
| 184 | CBT511 | Numeric | 1 |
| 185 | IVD512 | Numeric | 1 |
| 186 | VIDEO513 | Numeric | 1 |
| 187 | CLSRM514 | Numeric | 1 |
| 188 | SELF515 | Numeric | 1 |
| 189 | SIM516 | Numeric | 1 |
| 190 | EQUIP517 | Numeric | 1 |
| 191 | NOPEQ518 | Numeric | 1 |
| 192 | NO541 | Numeric | 1 |
| 193 | YES542 | Numeric | 1 |
| 194 | RBBM551 | Numeric | 1 |
| 195 | XPENS552 | Numeric | 1 |
| 196 | WTIME553 | Numeric | 1 |
| 197 | EQOBS554 | Numeric | 1 |
| 198 | NO611 | Numeric | 1 |
| 199 | YES612 | Numeric | 1 |
| 200 | FIFTY621 | Numeric | 1 |
| 201 | TFTF622 | Numeric | 1 |
| 202 | TTTF623 | Numeric | 1 |
| 203 | LTEN624 | Numeric | 1 |
| 204 | NO631 | Numeric | 1 |
| 205 | YES632 | Numeric | 1 |
| 206 | ISD641 | Numeric | 1 |
| 207 | NA651 | Numeric | 1 |
| 208 | OTFAM652 | Numeric | 1 |
| 209 | MPLEX653 | Numeric | 1 |
| 210 | UMBER654 | Numeric | 1 |
| 211 | NA655 | Numeric | 1 |
| 212 | MECON656 | Numeric | 1 |
| 213 | OSTLY657 | Numeric | 1 |
| 214 | REGS661 | Numeric | 1 |
| 215 | CDC662 | Numeric | 1 |
| 216 | STS663 | Numeric | 1 |
| 217 | TM671 | Numeric | 1 |
| 218 | TSEC672 | Numeric | 1 |
| 219 | USAF673 | Numeric | 1 |

| FLD# | Field Name | Type | NC |
|---|---|---|---|
| 220 | REGS674 | Numeric | 1 |
| 221 | NO711 | Numeric | 1 |
| 222 | YES712 | Numeric | 1 |
| 223 | MAN721 | Numeric | 1 |
| 224 | AUTO722 | Numeric | 1 |
| 225 | NAME7221 | Numeric | 1 |
| 226 | CAL72221 | Numeric | 1 |
| 227 | PAPER731 | Numeric | 1 |
| 228 | TIME732 | Numeric | 1 |
| 229 | UMBER733 | Numeric | 1 |
| 230 | STAND734 | Numeric | 1 |
| 231 | VALUE735 | Numeric | 1 |
| 232 | AUTO736 | Numeric | 1 |
| 233 | ATIME737 | Numeric | 1 |
| 234 | ACINF738 | Numeric | 1 |
| 235 | NONE7310 | Numeric | 1 |
| 236 | NO811 | Numeric | 1 |
| 237 | YES812 | Numeric | 1 |
| 238 | OTS821 | Numeric | 1 |
| 239 | QUEST822 | Numeric | 1 |
| 240 | NTSUP823 | Numeric | 1 |
| 241 | EXAMS824 | Numeric | 1 |
| 242 | NO831 | Numeric | 1 |
| 243 | YES832 | Numeric | 1 |
| 244 | CAL83221 | Numeric | 1 |
| 245 | REC_NO | Numeric | 3 |
| 246 | CONST911 | Numeric | 1 |
| 247 | DAILY912 | Numeric | 1 |
| 248 | OWEEK913 | Numeric | 1 |
| 249 | EEKLY914 | Numeric | 1 |
| 250 | NTHLY915 | Numeric | 1 |
| 251 | ARTLY916 | Numeric | 1 |
| 252 | NFORM921 | Numeric | 1 |
| 253 | MALA922 | Numeric | 1 |
| 254 | RMALS923 | Numeric | 1 |
| 255 | ILY92311 | Numeric | 1 |
| 256 | EEK92312 | Numeric | 1 |
| 257 | NTH92313 | Numeric | 1 |
| 258 | ART92314 | Numeric | 1 |
| 259 | NO931 | Numeric | 1 |
| 260 | WHY9311 | Numeric | 1 |
| 261 | YES932 | Numeric | 1 |
| 262 | ARE93211 | Numeric | 1 |
| 263 | ARN93212 | Numeric | 1 |
| 264 | LVE93213 | Numeric | 1 |

| FLD# | Field Name | Type | NC |
|---|---|---|---|
| 265 | ORD93214 | Numeric | 1 |
| 266 | ROB93215 | Numeric | 1 |
| 267 | ELP93216 | Numeric | 1 |
| 268 | YES1011 | Numeric | 1 |
| 269 | UND10111 | Numeric | 1 |
| 270 | FTY10112 | Numeric | 1 |
| 271 | IRT10113 | Numeric | 1 |
| 272 | IVE10114 | Numeric | 1 |
| 273 | ENT10115 | Numeric | 1 |
| 274 | EN10116 | Numeric | 1 |
| 275 | TEN10117 | Numeric | 1 |
| 276 | DK10118 | Numeric | 1 |
| 277 | NO1012 | Numeric | 1 |
| 278 | SSUF1021 | Numeric | 1 |
| 279 | ANPR1022 | Numeric | 1 |
| 280 | QUAL1023 | Numeric | 1 |
| 281 | WAYB1024 | Numeric | 1 |
| 282 | WAYT1025 | Numeric | 1 |
| 283 | ALIM1026 | Numeric | 1 |
| 284 | ILOR1027 | Numeric | 1 |
| 285 | OART1028 | Numeric | 1 |
| 286 | DSON1111 | Numeric | 1 |
| 287 | EXER1112 | Numeric | 1 |
| 288 | TIME1121 | Numeric | 1 |
| 289 | MPR1122 | Numeric | 1 |
| 290 | QUIP1123 | Numeric | 1 |
| 291 | DATE1124 | Numeric | 1 |
| 292 | NONE1126 | Numeric | 1 |
| 293 | DK1131 | Numeric | 1 |
| 294 | YES1132 | Numeric | 1 |
| 295 | CBT11321 | Numeric | 1 |
| 296 | IVD11322 | Numeric | 1 |
| 297 | DEO11323 | Numeric | 1 |
| 298 | SIM11324 | Numeric | 1 |
| 299 | NO1141 | Numeric | 1 |
| 300 | YES1142 | Numeric | 1 |
| 301 | IME11421 | Numeric | 1 |
| 302 | NDS11422 | Numeric | 1 |
| 303 | RTM11423 | Numeric | 1 |
| 304 | YES1211 | Numeric | 1 |
| 305 | NO1212 | Numeric | 1 |

# Appendix D-6

# Trainee Interview Code Sheets

## STRUCTURE OF TRAINEE DATA

| FLD# | Field Name | Type | NC |
|---|---|---|---|
| 1 | REC_NO | Numeric | 3 |
| 2 | CE111 | Numeric | 1 |
| 3 | MAINT112 | Numeric | 1 |
| 4 | MED113 | Numeric | 1 |
| 5 | MS114 | Numeric | 1 |
| 6 | PERS115 | Numeric | 1 |
| 7 | SP116 | Numeric | 1 |
| 8 | SUP117 | Numeric | 1 |
| 9 | TRANS118 | Numeric | 1 |
| 10 | MAC121 | Numeric | 1 |
| 11 | SAC122 | Numeric | 1 |
| 12 | TAC123 | Numeric | 1 |
| 13 | AFSC13 | Character | 7 |
| 14 | TIS14 | Numeric | 4 |
| 15 | YES151 | Numeric | 1 |
| 16 | OJT1511 | Numeric | 1 |
| 17 | FTD1512 | Numeric | 1 |
| 18 | CDC1513 | Numeric | 1 |
| 19 | NCIL1514 | Numeric | 1 |
| 20 | PME1515 | Numeric | 1 |
| 21 | NO152 | Numeric | 1 |
| 22 | OJT1521 | Numeric | 1 |
| 23 | FTD1522 | Numeric | 1 |
| 24 | CDC1523 | Numeric | 1 |
| 25 | NCIL1524 | Numeric | 1 |
| 26 | PME1525 | Numeric | 1 |
| 27 | NONE1527 | Numeric | 1 |
| 28 | H161 | Numeric | 1 |
| 29 | ENN162 | Numeric | 1 |
| 30 | SSN163 | Numeric | 1 |
| 31 | FFN164 | Numeric | 1 |
| 32 | TTN165 | Numeric | 1 |
| 33 | LTT166 | Numeric | 1 |
| 34 | CMS171 | Numeric | 1 |
| 35 | SMS172 | Numeric | 1 |
| 36 | MSG173 | Numeric | 1 |
| 37 | TSG174 | Numeric | 1 |
| 38 | SSG175 | Numeric | 1 |

| FLD# | Field Name | Type | NC |
|---|---|---|---|
| 39 | SGT176 | Numeric | 1 |
| 40 | SRAMN177 | Numeric | 1 |
| 41 | A1C178 | Numeric | 1 |
| 42 | AMN179 | Numeric | 1 |
| 43 | NBAS1710 | Numeric | 1 |
| 44 | CIV1711 | Numeric | 1 |
| 45 | POPE181 | Numeric | 1 |
| 46 | LANG182 | Numeric | 1 |
| 47 | OFF183 | Numeric | 1 |
| 48 | SCOTT184 | Numeric | 1 |
| 49 | MCCON185 | Numeric | 1 |
| 50 | ELLIS186 | Numeric | 1 |
| 51 | OTECH211 | Numeric | 1 |
| 52 | OUNIT212 | Numeric | 1 |
| 53 | ITBET213 | Numeric | 1 |
| 54 | CHBET214 | Numeric | 1 |
| 55 | SAME215 | Numeric | 1 |
| 56 | OOPIN216 | Numeric | 1 |
| 57 | NTECH221 | Numeric | 1 |
| 58 | TIME2211 | Numeric | 1 |
| 59 | VIRN2212 | Numeric | 1 |
| 60 | UIP2213 | Numeric | 1 |
| 61 | QUAL2214 | Numeric | 1 |
| 62 | TIME2215 | Numeric | 1 |
| 63 | NSIS2216 | Numeric | 1 |
| 64 | ORGN2217 | Numeric | 1 |
| 65 | ROAD2218 | Numeric | 1 |
| 66 | NUNIT222 | Numeric | 1 |
| 67 | REAL2221 | Numeric | 1 |
| 68 | DSON2222 | Numeric | 1 |
| 69 | ILOR2223 | Numeric | 1 |
| 70 | ALTR2224 | Numeric | 1 |
| 71 | NEON2225 | Numeric | 1 |
| 72 | EQUAL223 | Numeric | 1 |
| 73 | CBT311 | Numeric | 1 |
| 74 | IVD312 | Numeric | 1 |
| 75 | VIDEO313 | Numeric | 1 |
| 76 | CLSRM314 | Numeric | 1 |
| 77 | SELF315 | Numeric | 1 |
| 78 | SIM316 | Numeric | 1 |
| 79 | EQUIP317 | Numeric | 1 |
| 80 | NONOP318 | Numeric | 1 |

| FLD# | Field Name | Type | NC |
|---|---|---|---|
| 81 | DK3110 | Numeric | 1 |
| 82 | CBT321 | Numeric | 1 |
| 83 | IVD322 | Numeric | 1 |
| 84 | VIDEO323 | Numeric | 1 |
| 85 | CLSRM324 | Numeric | 1 |
| 86 | SELF325 | Numeric | 1 |
| 87 | SIM326 | Numeric | 1 |
| 88 | EQUIP327 | Numeric | 1 |
| 89 | NONOP328 | Numeric | 1 |
| 90 | NONE3210 | Numeric | 1 |
| 91 | ANDON331 | Numeric | 1 |
| 92 | EDBCK332 | Numeric | 1 |
| 93 | ETREF333 | Numeric | 1 |
| 94 | NPACE334 | Numeric | 1 |
| 95 | SELF335 | Numeric | 1 |
| 96 | CBT341 | Numeric | 1 |
| 97 | IVD342 | Numeric | 1 |
| 98 | VIDEO343 | Numeric | 1 |
| 99 | CLSRM344 | Numeric | 1 |
| 100 | SELF345 | Numeric | 1 |
| 101 | SIM346 | Numeric | 1 |
| 102 | EQUIP347 | Numeric | 1 |
| 103 | NONOP348 | Numeric | 1 |
| 104 | NONE3410 | Numeric | 1 |
| 105 | ORING351 | Numeric | 1 |
| 106 | OHAND352 | Numeric | 1 |
| 107 | NREAL353 | Numeric | 1 |
| 108 | REC_NO | Numeric | 3 |
| 109 | OBS411 | Numeric | 1 |
| 110 | QUEST412 | Numeric | 1 |
| 111 | PEINT413 | Numeric | 1 |
| 112 | EXAM414 | Numeric | 1 |
| 113 | YES421 | Numeric | 1 |
| 114 | NO422 | Numeric | 1 |
| 115 | DK423 | Numeric | 1 |
| 116 | YES431 | Numeric | 1 |
| 117 | NO432 | Numeric | 1 |
| 118 | PER43211 | Numeric | 1 |
| 119 | YES511 | Numeric | 1 |
| 120 | NO512 | Numeric | 1 |

# Appendix D-7

# Desert Shield/Storm Interview Code Sheets

## STRUCTURE OF DESERT STORM DATA

| FLD# | Field Name | Type | NC |
|---|---|---|---|
| 1 | REC_NO | Numeric | 3 |
| 2 | NO111 | Numeric | 1 |
| 3 | YES112 | Numeric | 1 |
| 4 | DEAST121 | Numeric | 1 |
| 5 | ARECH122 | Numeric | 1 |
| 6 | CONUS123 | Numeric | 1 |
| 7 | OTHER124 | Character | 25 |
| 8 | VEGHT131 | Numeric | 1 |
| 9 | VESIX132 | Numeric | 1 |
| 10 | REFOR133 | Numeric | 1 |
| 11 | NETWO134 | Numeric | 1 |
| 12 | RIDUTY14 | Character | 50 |
| 13 | TM151 | Numeric | 1 |
| 14 | TR152 | Numeric | 1 |
| 15 | TE153 | Numeric | 1 |
| 16 | COMDR154 | Numeric | 1 |
| 17 | SUPER155 | Numeric | 1 |
| 18 | NONE156 | Numeric | 1 |
| 19 | PREP211 | Numeric | 1 |
| 20 | OPREP212 | Numeric | 1 |
| 21 | YNOT2121 | Character | 100 |
| 22 | RMOJT221 | Numeric | 1 |
| 23 | EWSKL222 | Numeric | 1 |
| 24 | REIGN223 | Numeric | 1 |
| 25 | ANCIL224 | Numeric | 1 |
| 26 | ECIAL225 | Numeric | 1 |
| 27 | OTHER226 | Character | 100 |
| 28 | NONE227 | Numeric | 1 |
| 29 | IMMED231 | Numeric | 1 |
| 30 | INDEL232 | Numeric | 1 |
| 31 | NSDEL233 | Numeric | 1 |
| 32 | OLATE234 | Numeric | 1 |
| 33 | SUPER241 | Numeric | 1 |
| 34 | TR242 | Numeric | 1 |
| 35 | TDINS243 | Numeric | 1 |
| 36 | ME244 | Numeric | 1 |
| 37 | PERTS245 | Numeric | 1 |
| 38 | OWORK246 | Numeric | 1 |
| 39 | OTHER247 | Character | 100 |

| FLD# | Field Name | Type | NC |
|---|---|---|---|
| 40 | SREQS251 | Numeric | 1 |
| 41 | ALINS252 | Numeric | 1 |
| 42 | AILEQ253 | Numeric | 1 |
| 43 | GFACS254 | Numeric | 1 |
| 44 | TRESS255 | Numeric | 1 |
| 45 | OTHER256 | Character | 50 |
| 46 | NONE257 | Numeric | 1 |
| 47 | INSUR261 | Numeric | 1 |
| 48 | INSUR262 | Numeric | 1 |
| 49 | TEAM2621 | Numeric | 1 |
| 50 | THER2622 | Character | 100 |
| 51 | CONT271 | Numeric | 1 |
| 52 | AIVED272 | Numeric | 1 |
| 53 | OTREQ273 | Numeric | 1 |
| 54 | NDSON311 | Numeric | 1 |
| 55 | SELF312 | Numeric | 1 |
| 56 | GROUP313 | Numeric | 1 |
| 57 | CAI314 | Numeric | 1 |
| 58 | IVD315 | Numeric | 1 |
| 59 | VCR316 | Numeric | 1 |
| 60 | SIM317 | Numeric | 1 |
| 61 | CTURE318 | Numeric | 1 |
| 62 | OTHER319 | Character | 25 |
| 63 | NDSON321 | Numeric | 1 |
| 64 | SELF322 | Numeric | 1 |
| 65 | GROUP323 | Numeric | 1 |
| 66 | CAI324 | Numeric | 1 |
| 67 | IVD325 | Numeric | 1 |
| 68 | VCR326 | Numeric | 1 |
| 69 | SIM327 | Numeric | 1 |
| 70 | CTURE328 | Numeric | 1 |
| 71 | OTHER329 | Character | 25 |
| 72 | NDSON331 | Numeric | 1 |
| 73 | OREAL332 | Numeric | 1 |
| 74 | ONLY333 | Numeric | 1 |
| 75 | OTHER334 | Character | 150 |
| 76 | NDSON341 | Numeric | 1 |
| 77 | SELF342 | Numeric | 1 |
| 78 | GROUP343 | Numeric | 1 |
| 79 | CAI344 | Numeric | 1 |
| 80 | IVD345 | Numeric | 1 |
| 81 | VCR346 | Numeric | 1 |

| FLD# | Field Name | Type | NC |
|---|---|---|---|
| 82 | SIM347 | Numeric | 1 |
| 83 | CTURE348 | Numeric | 1 |
| 84 | OTHER349 | Character | 50 |
| 85 | NONE3410 | Numeric | 1 |
| 86 | YNOWRK35 | Character | 100 |
| 87 | NO361 | Numeric | 1 |
| 88 | YES362 | Numeric | 1 |
| 89 | DSON3621 | Numeric | 1 |
| 90 | SELF3622 | Numeric | 1 |
| 91 | ROUP3623 | Numeric | 1 |
| 92 | CAI3624 | Numeric | 1 |
| 93 | IVD3625 | Numeric | 1 |
| 94 | VCR3626 | Numeric | 1 |
| 95 | SIM3627 | Numeric | 1 |
| 96 | CTUR3628 | Numeric | 1 |
| 97 | THER3629 | Character | 100 |
| 98 | HERCHG37 | Character | 200 |
| 99 | SSLERN41 | Character | 200 |
| 100 | CHANGE42 | Character | 200 |

# Appendix E

# Data Processing and Data Analysis Plan

## DATA PROCESSING AND DATA ANALYSIS PLAN

This analysis plan assumes that data will be entered into a computer readable file by the Optical Scanning procedure.

1. **Lay-out of Analytic Data Files.** The creation of analytic data files from the OpScan form should be done by a person experienced with the data entry formats and procedures to be used for analysis. Data fields will be of fixed length, from the OpScan input. For items that are of the "Mark all that apply" type, a separate data field should be used for each alternative, entering a "1" if checked, and "0" if not checked. This permits easy analysis and easily created summary variables, such as the number of items checked on the question. For items with a response scale, e.g., "strongly agree" to "strongly disagree", the response letters should be converted to a numeric 1 to 5 scale, to permit quantitative analysis.

Explicit conventions should be set up for handling missing data elements and the "don't know/not applicable" responses - these conventions vary with the software being used for analysis, for example SAS or SPSS. "Missing data" also contain information and needs to be handled carefully, particularly so that these data elements do not interfere with the analysis of scaled data. For example, if "9" is used as a code for a "Not Applicable/Don't Know" response (a common convention), the software should be coded to exclude "9" from quantitative calculations.

2. **Analysis Software.** Use a software package designed for survey-type data analysis, such as SPSS or SAS. Both SAS and SPSS have advantages and disadvantages. SPSS's procedures for showing frequencies and simple tables work better than those in SAS. Also, SPSS has a very convenient procedure (called BREAKDOWN) for examining the mean responses to a scaled item for different subgroups, such as those from different AFSCs, grade levels, or lengths of service. SAS has nothing comparable, although it is possible to obtain the same results. A key criterion in choosing the software is the familiarity of the analyst with the software package to be used.

3. **Data Cleaning.** After data entry, as the first task after creating each analytical file, numerical data should be examined for any illegal values, or extreme outliers. If outliers are found, check against other data elements in the record, or in reference to the personnel data if correction is feasible. Change illegal values to a missing data code as a last resort. If a sequence of data for an individual appears to be invalid, the respondent may have placed answer codes with the

wrong item numbers. If the sequence is not correctable, it may be necessary to change the data from that page of the survey to the "missing data" codes.

4. **Data Analysis.** The following steps in data analysis, discussed sequentially, are appropriate for each form as its data become available after data entry and cleaning. After Step 1, not all the subsequent steps may be necessary, but each step provides much more information yield from the same data. With this type of exploratory survey data analysis, the range of specific analyses to be performed is very large (see below), so the expected outcomes cannot be predicted in advance.

**Step 1 - Frequencies.** Examine the numbers and percents for the full set of responses for each item. Does the distribution of responses make sense? If not, can the data be corrected by reference to another data item, so that aggregate summary data make sense and will not be misleading when reported? The frequencies and percents for many items are likely to be of interest in themselves, such as the types of training experienced, delivered or managed; the perceptions of problems encountered; the types of training technology used; and opinions about the current unit-level training situation. Graphs for presenting such items would be desirable.

**Step 2 - Create Summary Variables.** When constructing the surveys, items were created to cover each step of the ISD process, as well as to explore potential problem areas concerning each task in delivering and managing unit-level training. In addition, exploratory visits to Andrews and Randolph AFBs for pilot interviews with trainers, training managers, and trainees helped to delineate the processes and examples of problems occurring. This conceptual background was used to ensure coverage of the training process and will form the basis for summary variables for analysis. Attachment 1 provides a listing of all survey questions as they apply to specific categories of the ISD process. Those items that are demographic in nature are excluded.

The analysis is likely to be clearer and simpler to understand if summarizing and categorizing variables are derived at this point and added to the data file being analyzed. These variables tend to be of two types which are detailed below: 1) refined sets of categories to be used in later cross-tabulations, such as the AFSC job category; or 2) continuous variables measuring something on a numeric scale, such as a summary index of problems perceived with a specific type of training. Some examples of such variables follow:

1. AFSC categories - Create categorical variable to summarize career codes with a limited number of categories. The actual distribution of the original responses should be examined before deciding on the categories, so that a minimum of about 50 respondents are in each final category. Several related career codes may need to be grouped together, in order to yield a small enough number of categories for analysis.

2. Extent of automation used - For example, for the training managers, create a summary categorical variable to summarize the extent of automation used across several functions. such as scheduling, documentation, reporting and evaluation. The actual distributions of the data items and their correlations must be examined to determine what combinations may be useful to summarize across several individual items.

3. For sets of numeric items, such as those concerning problems in scheduling or documentation among training managers, scales can be created to summarize groups of items which show common tendencies among respondents. Use of such scales can simplify the reporting of results for these lengthy sets of items. For example, a single scale might summarize the responses to eight items for training managers concerning problems with scheduling of training. Use factor analysis (principal components) or examine the matrix of correlation coefficients to determine which items "go together" into a pattern that makes sense and can be given a name for easy interpretation. Then combine the responses for that set of items (usually, by obtaining the mean of non-missing values) for each respondent and add this mean value for each respondent as a new quantitative variable to the data set.

4. For a set of items on which the respondent checks off "all that apply", a useful summary variable would be a count of the number of items that each respondent checked on a specific set. For example, a count of the number of items checked on an item concerning the types of tasks performed by a trainer or training manager would summarize the breadth of that person's role in training activities.

**Step 3 - Cross-Tabulations and Comparisons of Means.** These analyses help to understand whether respondents from different backgrounds or with different experiences in the Air Force tend to react differently to the survey items. A cross-tabulation is a table for examining the relationship of one categorical variable to another categorical variable, usually using the $X^2$

statistic for testing the presence of an overall relationship. For example, do trainees from different AFSCs tend to experience different methods for job-related training? Do training managers with versus without the 75xxx code as their primary AFSC tend to have different functions in managing training? Do they use technology differently?

A comparison of means is used to examine differences among subgroups on a quantitative item, such as items scored from "strongly agree" to "strongly disagree," or a scale combining several such items. For example, do training managers coming from different types of squadrons tend to respond differently to the items about problems with documentation or scheduling? Do trainees from different AFSCs have different opinions about the training technology they have experienced?

A large number of exploratory analyses of this type are feasible, especially using the summary variables discussed above. The results of the most interesting or surprising of these analyses should then be presented in graphs.

Some of the sub-groups that would be useful to examine within these data concerning Squadron Level Training are the following:

- Types of units;

- AFSC job classes, collapsed as needed into major groupings;

- Training managers with versus without the 75xxx AFSC;

- Grade level, E-3 to E-9 (as relevant for each survey form);

- Major Command (MAJCOM);

- Years of active duty, categorized as less than 1, 1 to 2, 2 to 3, 3 to 4, or 4 or more for trainees; categorized as 1 to 4, 5 to 8, 9 to 12, 13 to 16, or more than 16 for trainers and training managers;

- Extent of civilian education, among trainees;

- Racial-ethnic background, among trainees;

- Gender, among trainees;

- Role in the training process, for trainers and managers;

- Training Managers who spend most/all of their duty time on training activities versus those who spend little of their duty time on training;

- Trainees who have experienced different types of training technologies.

**Step 4 - Correlational Analysis and Multiple Regression.** These techniques are used to understand relationships among continuous items, and to analyze more complex patterns of relationships. For example, one might want to examine what variables are related to a tendency to perceive fewer problems with a particular aspect of training, such as the use of specific training methods, belonging to certain types of units, the amount of duty time one spends on training, and so forth. Since these surveys are intended primarily to obtain descriptive information about current squadron-level training practices and perceived needs for the future, the items have not been designed to test particular hypotheses or causal models. Nevertheless, some exploratory analyses of potential relationships are likely to be feasible.

**Specific Analytic Questions.** The analytic steps outlined above all involve using the data from these three groups of respondents to understand the current extent of use of technologies for unit-level training, and respondents' assessments of the effectiveness, reliability, problems, or other applicable dimensions associated with that aspect of training. Interpreting the nature of the respondents' perceptions in light of the extent of their experience with a technology will provide information for making inferences concerning a match between future needs and technologies. Most sections of the surveys examine a specific Topic concerning training, such as OJT, Ancillary Training, or management functions such as Scheduling, Record-Keeping or Evaluation. Most sections use the following general logic to examine that Topic area, with the corresponding specific analytic questions (AQ):

A. What training has been experienced or which sub-tasks does the respondent do, in regard to this Topic?

AQ: What is the respondent's role/experience with this Topic?

B. What is the respondent's scope of use (e.g., % time on that activity, # years of experience) with that Topic?

C. What technologies/methods have been used for this Topic?

AQ: How extensive is the current use of training technologies in comparison with the use of other methods (manual, one-on-one instruction, etc.)?

AQ: Does the extent of use of technologies versus other methods differ for the various Topics? Differ among types of respondents?

AQ: Does the extent of use of training technologies in comparison with other methods differ by the respondents' roles or scope of use (i.e., items A & B)?

D. What are the respondents' assessments of the effectiveness, reliability, types of problems, etc. concerning that Topic and/or their use of technologies for it?

AQ: What are the major problems (needs) perceived at the Squadron level with local level training? Logically, are these problems that are likely to be addressable by new or changed technologies?

AQ: Are the assessments or problems (needs) related to the extent of use of a specific method? For example, do those who have experienced <u>more</u> extensive use of computerized training technologies tend to perceive more problems with them? If so, this may suggest needs for work on <u>technology</u> development, to make the technologies more appropriate or more reliable, etc. If the converse occurs, i.e., if those who have <u>less</u> experience with computerized technologies tend to perceive greater problems, this may suggest a need to work on implementation problems at the local level. Thus, the exact nature of the analyses cannot be specified in advance. Final analyses will depend on the findings from, and hypotheses suggested by, the initial analyses.

AQ: Are the reported assessments or problems (needs) related to the respondent's role or scope of use on that Topic? If so, these findings are likely to suggest hypotheses concerning the sources of squadron-level training problems (needs).

E. Each of the above analyses of Topic areas may also differ among one or more of the various sub-groups listed in Step 3 above. A large number of exploratory data tables will be examined to determine whether the findings for a Topic differ by sub-group, or can be safely generalized across the respondents to each survey. The presentation of reported results will include only those sub-group analyses that show meaningful differences among sub-groups.

F. A further section of the trainers' and training managers' surveys provides a scenario of expanded responsibilities for training at the Squadron level in the future, and asks a number of items concerning the respondents' expectations for further technology needs in the future. To the extent that respondents are able to respond thoughtfully to these items, they will provide rich data concerning expected future needs for training and training technologies in case residential training is reduced.

The analysis of these surveys will provide a detailed view of the current status of training at the squadron level including problems in the training process, the use of training technologies at the squadron level, as well as assessments of positive and negative aspects of that use. The use of these analyses for matching future "needs" and "technologies" will be from logical interpretations of the survey findings in relation to the potential uses and characteristics of technologies - both those currently available and feasible future developments. For this logical analysis, additional information about the nature of the technologies, gathered through archival research, will be used to identify appropriate technologies that address current and future needs for squadron level training.

# Appendix F

# Relating Training System Needs to Training Technologies (Phase I Extract)

# RELATING TRAINING SYSTEM NEEDS TO TRAINING TECHNOLOGIES

This chapter describes the process by which the needs of the unit-level training system were systematically identified, documented and matched to HSD training technologies. In the previous chapter, researchers identified a number of general problems in the unit-level training system for PACAF F-16 maintenance units. Researchers described these problems with broad narrative statements based on the results of their content analyses. However, these broadly-defined problems, while insightful in and of themselves, required further analysis before they could be related to training technologies. This chapter documents the efforts of researchers to identify the specific training system functions implicated by these problem descriptions as being deficient, and subsequently, to relate them to the functions of HSD training technologies.

The impetus for this line of Air Force research lies in the certainty that force structure and budgetary levels will continue the trend of systematic reductions and short-term adjustments to immediate fiscal shortfalls. This activity constitutes an intermediate step in the development of a long-range S&T Investment Strategy with the establishment of a framework with which to focus the emerging technologies against concrete user needs. Matching of training needs and technologies is only a preliminary step, however, since this phase of the research initiative examined only a narrow segment of the Air Force training domain (i.e., F-16 aircraft maintenance units deployed in the Pacific theater). Accordingly, suggestions will be made for further research that will attempt to generalize the results of this data collection across a larger segment of the Air Force's vast training system.

## A. Analytic Framework: ISD Model

A review of available training literature and AF training research revealed that no clear-cut or systematic methodologies existed for identifying, documenting and relating training system needs to training technologies (Carson, Chambers & Gosc, 1984; Chenzoff et al., 1984; Stephenson & Burkett, 1975). Most of the research in this area has focused on training needs assessment and has not attempted to identify and relate the needs of the training system to potential technology solutions.

This study adopted a "training system needs assessment" approach as opposed to a traditional training needs assessment approach. The distinction between the two is important here. On the one hand, a training needs assessment "provides information on where training is needed, what the content of the training should be, and who within the organization needs training in certain kinds of skills and knowledge (Ostroff & Ford, 1989)." This type of assessment stresses the importance of three interrelated

components: organization, task, and person. A training system needs assessment, on the other hand, provides information on which processes or functions in the training system need improvement. These processes can be broadly stated as planning, programming, management, evaluation, development and delivery of training. Consequently, training needs assessment would be one process within this system.

The basic analytic framework chosen for this research was the Instructional System Development (ISD) model. This model had several features which made it appropriate for this purpose. First, the ISD model covered a wide range of training activities, including planning, programming, development, delivery, management, and evaluation. Moreover, the model can be defined at such a level as to differentiate between the unique functions of various training technologies. Many technologies, while somewhat similar, are intended to enhance different aspects of the same general training area. For example, two technologies might enhance training management but do so in qualitatively different areas, such as resource scheduling and student tracking. A broadly defined framework would not capture these nuances. Fortunately, the ISD model allowed us to describe training technologies and research at a meaningful and analytically useful level.

The ISD model is also widely accepted within the AF and other training communities, although the exact form of this model is a matter of continuing debate. AFM 50-2 and AFP 50-58, in particular, formed the basis of the framework. The final version, as seen in figure 3, was the result of repeated reviews and modifications by AL/HRT ISD experts. Each of the processes is defined in Appendix F.

### 3. Applying the Analytic Framework

The process of matching training technologies to training system needs occured in three steps. In the first step, researchers developed profiles for a selected group of training technologies based on the analytic framework shown in figure 3. The "technology profiles" contained the specific ISD processes (i.e., training functions) which were enhanced by a technology. Next, researchers examined the general training system problems identified during analysis of the interview data to determine the specific ISD processes which needed improvement. As such, the "training system problem profiles" contained the specific ISD processes which needed improvement according to the researcher's interpretation of the general problem description. In the final step, the technology profiles were compared to the training system problem profiles, and areas of overlap and non-overlap were noted. Following is a discussion of the procedures and results of this matching process.

Figure 3. Analytic Framework Based On Instructional System Development Model

| INSTRUCTIONAL SYSTEM DEVELOPMENT | PROCESSES | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| ANALYZE SYSTEM REQUIREMENTS | TRNG NEEDS ASSESSMENT | | | | | | | | |
| | analyze situation | | | | | | | | |
| | identify parameters | | | | | | | | |
| | DEFINE/ANALYZE JOB PERFORMANCE RQTS | | | | | | | | |
| | develop task listing | | | | | | | | |
| | analyze job tasks | | | | | | | | |
| | est. target pop characteristics | | | | | | | | |
| DEFINE EDUCATION & TRAINING RQTS | SELECT TASKS REQUIRING TRNG | | | | | | | | |
| | DETERMINE STUDENT PREREQUISITES | | | | | | | | |
| | SELECT APPROPRIATE TRNG SETTING | | | | | | | | |
| | FORECAST RESOURCE/LOGISTIC RQTS | | | | | | | | |
| DEVELOP OBJECTIVES & TESTS | DEVELOP OBJECTIVES | | | | | | | | |
| | DEVELOP TESTS | | | | | | | | |
| | DEVELOP JOB PERF TESTING METHODS | | | | | | | | |

Note. Adapted from AF Manual 50-2 and AF Pamphlet 50-58

(Figure 3 continued)

| INSTRUCTIONAL SYSTEM DEVELOPMENT | PROCESSES | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| PLAN, DEVELOP & VALIDATE INSTRUCTION | PLAN SEQUENCE OF INSTRUCTION | | | | | | | | |
| | SELECT INSTRUCTIONAL METHOD | | | | | | | | |
| | eval alternative instr methods | | | | | | | | |
| | select instructional method | | | | | | | | |
| | establish detailed course design | | | | | | | | |
| | SELECT INSTRUCTIONAL MEDIA | | | | | | | | |
| | evaluate candidate media | | | | | | | | |
| | select instructional media | | | | | | | | |
| | develop system specifications | | | | | | | | |
| | DETERMINE RESOURCE AND FUNDING RQTS | | | | | | | | |
| | DEVELOP INSTRUCTIONAL MATERIALS | | | | | | | | |
| | author instructional material | | | | | | | | |
| | produce instructional material | | | | | | | | |
| | VALIDATE INSTRUCTIONAL MATERIALS | | | | | | | | |
| | review courseware prototype | | | | | | | | |
| | individual & small group tryouts | | | | | | | | |
| | VALIDATE COMPLETE SYSTEM | | | | | | | | |

## (Figure 3 continued)

| INSTRUCTIONAL SYSTEM DEVELOPMENT | PROCESSES | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| CONDUCT & EVALUATE | DELIVER INSTRUCTION | | | | | | | | |
| | SUPPORT INSTRUCTION | | | | | | | | |
| | schedule students | | | | | | | | |
| | schedule resources | | | | | | | | |
| | track student progress | | | | | | | | |
| | manage training rqts | | | | | | | | |
| | maintain & update instr system | | | | | | | | |
| | EVALUATE INSTRUCTION | | | | | | | | |
| | evaluate student performance | | | | | | | | |
| | evaluate job performance | | | | | | | | |
| | measure utility & cost-benefit | | | | | | | | |

Training Technology Profiles

HSD has a number of training technologies currently under development (Appendix E). The impetus for training technology research comes from a number of different sources including formal requests from AF organizations as well as self-initiated research in response to anticipated needs. Yet, whatever their source is, these technologies have one goal in common, to improve the effectiveness or efficiency of one or more parts of the training system. The objective of this step of the matching process was to develop a profile for each of the selected training technologies by identifying those parts of the training system which they were intended to enhance. In other words, each technology is intended to add to the knowledge or technology base of one or more of the ISD processes.

The term "training technology," as it is used here, requires some explanation. Rousseau defined technology as "a process for transforming physical and information inputs into outputs (1983, p. 225)." As such, a training technology can refer to a wide range of items, including hardware, software, research procedures, data collection instruments, and analysis tools. In this study, researchers were primarily concerned with research projects and not necessarily individual training technologies, per se. These projects may, in fact, develop and integrate several types of training technologies into one system in order to achieve a specific goal or meet a specific need. For simplicity sake, however, a project will be referred to as a training technology, whether it encompasses a single technology or a system of integrated technologies.

The most reliable sources of information about the training technologies were project managers and laboratory technical directors. These people possessed the most accurate and up-to-date knowledge about the specific projects and could identify the specific training functions that the technologies were designed to enhance. Researchers provided the laboratory technical directors who were responsible for technical training-related research with the ISD-technology matrix seen in Figure 4 and asked them to indicate below each of their technologies the specific training processes being enhanced (i.e., the knowledge or technical base of that ISD process is increased). They also received a list of definitions clarifying the function of each ISD process. The final set of profiles (Figure 4) represents the collaborative efforts of the technical directors and the project managers who oversaw the research and development of the individual technologies.

The technology profiles presented here portray the intended final form of the technologies. Since these technologies are currently under development, their profiles may or may not change with time. For example, the Advanced On-The-Job Training System (AOTS) evolved into a production ready technology, the Base Training System, which provides only a portion of the training functions of the original technology prototype. It went from

**Figure 4. Profiles Cataloguing the ISD Processes Enhanced By Each Training Technology**

| INSTRUCTIONAL SYSTEM DEVELOPMENT | PROCESSES | ADV INSTRUCTIONAL DESIGN ADVISOR | ADVANCED OJT SYSTEM/BTS | BASIC JOB SKILLS | CBT SELECTION ADVISOR | CODAP | FUNDAMENTAL SKILLS TRAINING | JOB-AIDED/TRNG ALLOCATION TECH | JOB PERFORMANCE MEASUREMENT | INSTRUCTIONAL SUPPORT SYSTEM | INTEGRATED MAINT INFO SYSTEM | INTEL COMP-AIDED TRNG TESTBEDS | INTELLIGENT TUTORING SYSTEMS | LOGISTICS COMMAND AND CONTROL | TRNG DECISIONS MODELING TECH | TRAINING EVALUATION |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| ANALYZE SYSTEM REQUIREMENTS | TRNG NEEDS ASSESSMENT | | | | | | | | | | | | | | | |
| | analyze situation | | | | | | ● | ● | | | | | | | | |
| | identify parameters | | | | ● | | | ● | | | | | | ● | | |
| | DEFINE/ANALYZE JOB PERFORMANCE RQTS | | | | | | | | | | | | | | | |
| | develop task listing | | ● | | | ● | | | | | | | | | ● | |
| | analyze job tasks | | ● | ● | | | | | | | | | | ● | | |
| | est. target pop characteristics | | | | | | ● | | | | | | | | | |
| DEFINE EDUCATION & TRAINING RQTS | SELECT TASKS REQUIRING TRNG | | ● | | | ● | | ● | | | | | | | | ● |
| | DETERMINE STUDENT PREREQUISITES | | | | | | ● | | | | | | | | | |
| | SELECT APPROPRIATE TRNG SETTING | | | | | | | ● | | | | | | | ● | |
| | FORECAST RESOURCE/LOGISTIC RQTS | | ● | | ● | | | | | | | | | | ● | |
| DEVELOP OBJECTIVES & TESTS | DEVELOP OBJECTIVES | ● | ● | ● | | | | | | | | | | | | |
| | DEVELOP TESTS | ● | ● | | | ● | | | | | | | | | | ● |
| | DEVELOP JOB PERF TESTING METHODS | | | | | | | | ● | | | | | | | ● |

● DENOTES THAT A PROJECT ADDS TO THE TECHNOLOGY OR KNOWLEDGE BASE OF A PROCESS

(Figure 4 continued)

| INSTRUCTIONAL SYSTEM DEVELOPMENT | PROCESSES | ADV INSTRUCTIONAL DESIGN ADVISOR | ADVANCED OJT· SYSTEM/BTS | BASIC JOB SKILLS | CBT SELECTION ADVISOR | CODAP | FUNDAMENTAL SKILLS TRAINING | JOB-AIDED/TRNG ALLOCATION TECH | JOB PERFORMANCE MEASUREMENT | INSTRUCTIONAL SUPPORT SYSTEM | INTEGRATED MAINT INFO SYSTEM | INTEL COMP-AIDED TRNG TESTBEDS | INTELLIGENT TUTORING SYSTEMS | LOGISTICS COMMAND AND CONTROL | TRNG DECISIONS MODELING TECH | TRAINING EVALUATION |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| PLAN, DEVELOP & VALIDATE INSTRUCTION | PLAN SEQUENCE OF INSTRUCTION | ● | | | | | | | | | | | | | | |
| | SELECT INSTRUCTIONAL METHOD | | | | | | | | | | | | | | | |
| | eval alternative instr methods | ● | | | ● | | | | | | | | | | | ● |
| | select instructional method | ● | | | | | | | | | | | | | | |
| | establish detailed course design | ● | | ● | | | | | | | | | | | | |
| | SELECT INSTRUCTIONAL MEDIA | | | | | | | | | | | | | | | |
| | evaluate candidate media | | | | ● | | | | | | | | | | | |
| | select instructional media | | | | ● | | | | | | | | | | | |
| | develop system specifications | | | | ● | | | | | | | | | | | |
| | DETERMINE RESOURCE AND FUNDING RQTS | | ● | | ● | | | | | | | | | | ● | |
| | DEVELOP INSTRUCTIONAL MATERIALS | | | | | | | | | | | | | | | |
| | author instructional material | ● | ● | ● | | | | | | ● | ● | ● | | | | |
| | produce instructional material | ● | ● | ● | | | | | | ● | | ● | | | | |
| | VALIDATE INSTRUCTIONAL MATERIALS | | | | | | | | | | | | | | | |
| | review courseware prototype | | | | | | | | | | | | | | | |
| | individual & small group tryouts | | | | | | | | | | | | | | | |
| | VALIDATE COMPLETE SYSTEM | | | | | | | | ● | | | | | | | ● |

● DENOTES THAT A PROJECT ADDS TO THE TECHNOLOGY OR KNOWLEDGE BASE OF PROCESS

## (Figure 4 continued)

| INSTRUCTIONAL SYSTEM DEVELOPMENT | PROCESSES | ADV INSTRUCTIONAL DESIGN ADVISOR | ADVANCED OJT SYSTEM/BTS | BASIC JOB SKILLS | CBT SELECTION ADVISOR | CODAP | FUNDAMENTAL SKILLS TRAINING | JOB-AIDED/TRNG ALLOCATION TECH | JOB PERFORMANCE MEASUREMENT | INSTRUCTIONAL SUPPORT SYSTEM | INTEGRATED MAINT INFO SYSTEM | INTEL COMP-AIDED TRNG TESTBEDS | INTELLIGENT TUTORING SYSTEMS | LOGISTICS COMMAND AND CONTROL | TRNG DECISIONS MODELING TECH | TRAINING EVALUATION |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| CONDUCT & EVALUATE | DELIVER INSTRUCTION | ● | ● | ● | | | | | | ● | | ● | ● | ● | | |
| | SUPPORT INSTRUCTION | | | | | | | | | | | | | | | |
| | schedule students | | ● | | | | | | | ● | | | | | | |
| | schedule resources | | ● | | | | | | | ● | | | | | | |
| | track student progress | | ● | ● | | | | | | ● | | | | | | |
| | manage ind training rate | | ● | | | | | | | | | | | | | |
| | maintain & update instr system | | ● | | | ● | | | | | ● | | | | | |
| | EVALUATE INSTRUCTION | | | | | | | | | | | | | | | |
| | evaluate internal validity | | ● | | | | | | | | | | | | | ● |
| | evaluate external validity | | ● | | | | | | ● | | | | | | | |
| | measure utility & cost-benefit | | | | | | | | | | | | | | | |

● DENOTES THAT A PROJECT ADDS TO THE TECHNOLOGY OR KNOWLEDGE BASE OF A PROCESS

being an integrated management, evaluation, development and delivery system for OJT to a management-oriented system. Nevertheless, the profiles, as presented here, provide a snap-shot of the current direction of AF training technologies.

Training System Problem Profiles

Technology profiles represented one side of the equation in the matching process. On the other side were the profiles for the training system problems. Their purpose was to systematically document those functions of the training system which researchers suspected to be deficient based on their analysis of unit-level training requirements and capabilities (see Table 6 a summary of the training problems). The same ISD analytic framework used by technical directors and project managers to describe their technologies were also used by researchers to translate descriptions of training system problems into sets of specific training system needs. The results of the analyses are shown in Figure 5. Solid circles represent processes where evidence strongly suggests an ISD process is being inadequately performed at the unit level and thus needs improvement. Empty circles represent ISD processes where evidence inconclusively suggests improvements are needed.

Following are the rationale behind construction of each of the problem profiles:

1. **Inappropriate Training Requirements.** This situation strongly indicated a deficiency in the ISD process entitled "select tasks requiring training." Maintainers felt that some of the globally imposed training requirements, such as block training, were entirely inappropriate or overtrained. They also felt that there was an absence or lack of training in others areas, such as CAMS, troubleshooting, basic system knowledge, and Chemical Warfare. Moreover, individuals at the unit-level suffered because managers and supervisors were uncomfortable or unable to make decisions on training content for any individual. This, in turn, negatively impacted the "management of training requirements" at the units. The situation described here strongly suggests that the mechanisms for selecting tasks requiring training, at the unit-level and higher, were either flawed or unavailable.

This situation may also reflect deficiencies in the processes for "developing task listings" and "analyzing job tasks." For example, an inaccurate job task listing can lead to inappropriate training if it includes irrelevant tasks or to a lack of training if it excludes relevant tasks. Moreover, if tasks were not properly analyzed, they could lead to over- or under-training. Given the level of data and primitive state of the framework, however, these conclusions are speculative at best.

## Figure 5. ISD Processes Indicated As Deficient By Training System Problems

| INSTRUCTIONAL SYSTEM DEVELOPMENT | PROCESSES | INAPPROPRIATE TRAINING REQUIREMENTS | LACK OF QUALIFIED INSTRUCTORS/TRAINERS | MANPOWER AND PERSONNEL POLICIES | NEED FOR ENHANCED HANDS-ON TRAINING/OJT | LACK OF TRAINING OPPORTUNITIES | LIMITED TRAINING TIME | LACK OF ENROUTE TRAINING | INADEQUATE FEEDBACK MECHANISMS | INADEQUATE JPM PROCEDURES | LACK OF TDY FUNDING | IMPLEMENTATION PROBS W/ TRNG MEDIA | SUMMARY OF TRAINING SYSTEM NEEDS |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| ANALYZE SYSTEM REQUIREMENTS | TRNG NEEDS ASSESSMENT | | | | | | | | | | | | |
| | analyze situation | | | | | | | | | | | | |
| | identify parameters | | | | | | | | | | | | |
| | DEFINE/ANALYZE JOB PERFORMANCE RQTS | | | | | | | | | | | | |
| | develop task listing | ○ | | | | | | | | | | | ○ |
| | analyze job tasks | ○ | | | | | | | | | | | ○ |
| | est target pop characteristics | | | | | | | | | | | | |
| DEFINE EDUCATION & TRAINING RQTS | SELECT TASKS REQUIRING TRNG | ● | ● | | | ● | | | | | | | ● |
| | DETERMINE STUDENT PREREQUISITES | | | | | | | | | | | | |
| | SELECT APPROPRIATE TRNG SETTING | | ● | | | | | | | | ○ | | ● |
| | FORECAST RESOURCE/LOGISTIC RQTS | | ● | | | | | | | | ○ | | ● |
| DEVELOP OBJECTIVES & TESTS | DEVELOP OBJECTIVES | | | | | | | | | | | | |
| | DEVELOP TESTS | | | | | | | | | | | | |
| | DEVELOP JOB PERF TESTING METHODS | | | | | | | | | ● | | | ● |

● EVIDENCE STRONGLY SUPPORTS THE EXISTENCE OF A DEFICIENCY IN PROCESS

○ EVIDENCE PROVIDES SOME SUPPORT FOR DEFICIENCY IN PROCESS (INCONCLUSIVE)

(Figure 5 continued)

| INSTRUCTIONAL SYSTEM DEVELOPMENT | PROCESSES | INAPPROPRIATE TRAINING REQUIREMENT | LACK OF QUALIFIED INSTRUCTORS/TRAII | MANPOWER AND PERSONNEL POLICIES | NEED FOR ENHANCED HANDS-ON TRAINII | LACK OF TRAINING OPPORTUNITIES | LIMITED TRAINING TIME | LACK OF ENROUTE TRAINING | INADEQUATE FEEDBACK MECHANISMS | INADEQUATE JPM PROCEDURES | LACK OF TDY FUNDING | IMPLEMENTATION PROBS W/ TRNG MEDIA | SUMMARY OF TRAINING SYSTEM N |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| PLAN, DEVELOP & VALIDATE INSTRUCTION | PLAN SEQUENCE OF INSTRUCTION | | | | | | | | | | | | |
| | SELECT INSTRUCTIONAL METHOD | | | | ● | | ● | | | | | | ● |
| | eval alternative instr methods | | | | | | | | | | | | |
| | select instructional method | | | | | | | | | | | | |
| | establish detailed course design | | | | | | | | | | | | |
| | SELECT INSTRUCTIONAL MEDIA | | | | ● | ● | ● | | | | | ● | ● |
| | evaluate candidate media | | | | | | | | | | | | |
| | select instructional media | | | | | | | | | | | | |
| | develop system specifications | | | | | | | | | | | | |
| | DETERMINE RESOURCE AND FUNDING RQTS | | | | | | | | | | | ● | ● |
| | DEVELOP INSTRUCTIONAL MATERIALS | | | | | | | | | | | | |
| | author instructional material | | | | | | | | | | | | |
| | produce instructional material | | | | | | | | | | | | |
| | VALIDATE INSTRUCTIONAL MATERIALS | | | | | | | | | | | | |
| | review courseware prototype | | | | | | | | | | | | |
| | individual & small group tryouts | | | | | | | | | | | | |
| | VALIDATE COMPLETE SYSTEM | | | | | | | | | | | | |

● EVIDENCE STRONGLY SUPPORTS THE EXISTENCE OF A DEFICIENCY IN PROCESS

○ EVIDENCE PROVIDES SOME SUPPORT FOR A DEFICIENCY IN PROCESS (INCONCLUSIVE)

## (Figure 5 continued)

| INSTRUCTIONAL SYSTEM DEVELOPMENT | PROCESSES | INAPPROPRIATE TRAINING REQUIREMENTS | LACK OF QUALIFIED INSTRUCTORS/TRAINERS | MANPOWER AND PERSONNEL POLICIES | NEED FOR ENHANCED HANDS-ON TRAINING/OJT | LACK OF TRAINING OPPORTUNITIES | LIMITED TRAINING TIME | LACK OF ENROUTE TRAINING | INADEQUATE FEEDBACK MECHANISMS | INADEQUATE JPM PROCEDURES | LACK OF TDY FUNDING | IMPLEMENTATION PROBS W/ TRNG MEDIA | SUMMARY OF TRAINING SYSTEM NEEDS |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| CONDUCT & EVALUATE | DELIVER INSTRUCTION | | | | ● | | ● | | | | | | ● |
| | SUPPORT INSTRUCTION | | | | | | | | | | | | |
| | schedule students | | | | | | | ● | | | | | ● |
| | schedule resources | | ● | | | | | | | | | | ● |
| | track student progress | | | | | | | | | | | | |
| | manage ind training rate | ● | | | | | | | | | | | ● |
| | maintain & update instr system | | | | | | | | ● | | | | ● |
| | EVALUATE INSTRUCTION | | | | | | | | | | | | |
| | evaluate internal validity | | | | | | | | | | | | |
| | evaluate external validity | | | | | | | | ● | | | | ● |
| | measure utility & cost-benefit | | | | | | | | | | | | |

● EVIDENCE STRONGLY SUPPORTS EXISTENCE OF A DEFICIENCY IN PROCESS

○ EVIDENCE PROVIDES SOME SUPPORT FOR A DEFICIENCY IN PROCESS (INCONCLUSIVE)

2. **Lack of Qualified Instructors and OJT Trainers.** This situation was largely a resource problem, in terms of both quantity and quality. The lack of available instructors (i.e., the quantity problem) indicated deficiencies in the ability to "select appropriate training settings" and "forecast resource/logistic requirements." On the one hand, there was a failure to adequately forecast and assign the necessary number of instructors to FTDs, MATs, and units (although this may have been a function of external constraints such as manpower shortages). On the other hand, this situation indicates that training was inappropriately allocated to training settings with insufficient resources. This situation may also indicate an inability at the unit level to properly "schedule resources" for training. When instructors were available, many of them appeared to lack technical competency and/or teaching abilities. The latter situation strongly indicates that a problem existed in the "selection training requirements" for instructors. This conclusion is further supported by the apparent lack of available courses on the subject of teaching. However, the evidence surrounding the former problem, i.e., lack of technical competency, is for the most part unclear as to its implications. It may indicate potential deficiencies in a number of training processes, but further investigation would be required to determine which ones resulted in the lack of technical competence amongst some instructors.

3. **Manpower and Personnel Policies.** This situation does not implicate any specific training process. It is, in fact, an external factor (situational constraint) which adversely affects the training system by increasing training requirements.

4. **Enhanced Hands-On Training/OJT.** This situation is quite broad in its implications, suggesting improvement to all aspects of OJT including planning, management, evaluation, development and delivery. The emphasis, however, is on "delivery" and the need for "instructional methods" and "instructional media" which accentuate hands-on skill training. It is unclear from the data which, if not all, of the subprocesses in the selection of instructional methods and media are implicated by this problem.

5. **Lack of Training Opportunities Due To Improved Weapon System Technology.** This situation clearly indicates the need for instructional developers to "select instructional media" which will enable maintainers to train on tasks which infrequently occur because of extremely high weapon system reliability rates. This also indicates a need for an improved "training requirements selection" process so that

infrequently performed task are identified for recurring training.

6. **Limited Training Time Due To Operational Commitments.** This situation is quite complex and indicates areas needing improvement within training and external to it. External factors which limit time include mission requirements and limited manpower. The implication for training is to increase the efficiency and availability of training through enhanced "selection of instructional methods" and "media" and to make "delivery" of training more accessible/convenient.

7. **Lack of Enroute Training.** The circumstances surrounding this situation point to problems in the assignment process and deficiencies in the "scheduling of students." According to interviewees, the procedures for scheduling students for enroute training were slow and unreliable.

8. **Inadequate Feedback Mechanisms For Evaluating Training Courses.** This situation indicates a need for enhanced feedback mechanisms to support the "maintenance and update of the instructional system" and the "evaluation of the external validity of the instructional product." Maintainers had mixed impressions about whether or not their inputs regarding the content of training courses were being received and, when received, used by course developers to evaluate and update their courses.

9. **Inadequate Job Performance Measurement Procedures.** This situation points to deficiencies in the "development of job performance testing procedures". Maintainers claimed that QA evaluations were unstandardized and inconsistent across evaluators. Moreover, many of the maintainers and some QA personnel felt that the evaluations were not a good measure of a unit's capabilities since the same set of personnel seemed to be evaluated every time QA visited a unit. For example, personnel on swing shifts rarely were evaluated. QA evaluators were also criticized for not being proficient in the tasks they evaluated. This problem, however, seemed to be a temporary one brought about by Rivet Workforce training requirements and should dissipate once QA personnel become more familiar with the rivetized tasks. (QA personnel also performed evaluations of student performance in conjunction with AMQP. However, it is unclear from the data whether or not these training evaluations suffered from the same lack of standardization as did the job performance evaluations.)

10. **Lack of TDY Funding.** This situation is predominantly a reflection of recent budget cutbacks. It is likely,

however, that training managers were unable to forecast the resource, cost, and performance impacts of their decisions and, therefore, provided relied on OJT rather than sending someone TDY to school. This, in turn, indicates training settings were inappropriately selected (i.e., selection by default). For example, training someone on a certain task or set of tasks in OJT may be more costly in terms of labor hours and resources than sending that person TDY.

11. **Implementation Problems with New Training Media.** This situation pertains to IVD technology, in particular, and indicates that resources were not properly identified and provided to support IVD use and implementation at the unit-level. Moreover, training personnel did not know when, where, or how to use that particular media.

The interview data and findings from the content analysis strongly support the existence of deficiencies in a large number of training processes. These deficiencies represent deficiencies with the unit-level training system as a whole and are not necessarily confined to the units themselves. For example, many of the processes at the front-end of the framework (i.e., "Analyze System Requirements"; "Define Education and Training Requirements"; "Develop Tests and Objectives"; "Plan, Develop and Validate Instruction") are often accomplished by organizations outside the unit-level. The results of these activities, however, are nonetheless intimately linked to the unit-level training system. It is important to understand unit-level training as a system and not as an isolated activity.

Table 7 contains a summary of the specific ISD processes implicated by the problems described in previous chapters. Only those processes which are strongly supported by the data are listed here. The degree to which each of the processes is deficient is unclear since no metric existed for determining the severity of each problem. Based on the number of problem descriptions (Table 6) which implicated a particular process, it would appear that "Selection of Tasks Requiring Training", "Selection of Instructional Media", "Selection of Instructional Methods", and "Delivery of Training" are the processes with more pronounced deficiencies. However, such a finding would be extremely tentative.

The results of this analysis should be interpreted cautiously for several reasons. First, it is likely that other researchers would have differing interpretations of the problems described in this paper, and therefore, differing profiles and conclusions. Second, since instructional development is an integrated process, it becomes difficult to implicate any single process as being deficient. Problems may result from weaknesses in several processes, or the deficiencies in one process may overshadow or mask deficiencies in others. Finally, the results are limited by the specificity and scope of the Phase I SLT data. Researchers

developed the analytic framework used in this analysis after data collection had already been completed. Consequently, this framework did not guide the data collection effort. Data collection was instead guided by a similar, yet much broader,

Table 7

Summary of Training Processes Implicated by SLT Phase I Findings

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1) Selection of Tasks Requiring Training;
2) Selection of Appropriate Training Settings;
3) Forecast of Resource/Logistics Requirements;
4) Development of Job Performance Testing Standards;
5) Selection of Instructional Methods;
6) Selection of Instructional Media;
7) Delivery of Instruction;
8) Scheduling of Students;
9) Scheduling of Resources;
10) Management of Individual Training Requirements;
11) Maintenance and Update of Instructional Systems; and,
12) Evaluation of External Validity of Instructional Product.

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framework than the ISD model provided. This limited the ability of researchers to identify accurately the specific training system needs implied by the data. They were, for example, unable to identify the specific ISD processes within media and method selection implicated by the problem descriptions. This inability was largely due to the lack of specificity in the data collected. Such a situation could have been avoided if data collection had been focused along the lines of the ISD-based analytic framework.

## Training Needs-Technology Match

The final step in the matching process involved a comparison of the technology and training system deficit profiles. The purpose of such a comparison is to reveal where training system needs are being addressed by AF training research and where they are not. The results of the matching process can be seen in Figure 6. The shaded areas represent processes which were implicated as being deficient from earlier analyses. An overlap (or "hit") exists when solid circle appears in the shaded area. This indicates that the deficient ISD process is addressed by a training technology. The mere fact that an overlap exists, however, is not confirmation in and of itself that a system need is being addressed. Since the analytic framework used in this matching process is very basic and only considers function, researchers have to consider other issues such as the context surrounding a training need (domain) and the degree to which a technology addressed this context in addition to the basic overlap.

Figure 6. Training Technology and Training System Needs Match Indicating Areas For Potential Application

| INSTRUCTIONAL SYSTEM DEVELOPMENT | PROCESSES | ADV INSTRUCTIONAL DESIGN ADVISOR | ADVANCED OJT SYSTEM/BTS | BASIC JOB SKILLS | CBT SELECTION ADVISOR | CODAP | FUNDAMENTAL SKILLS TRAINING | JOB-AIDED/TRNG ALLOCATION TECH | JOB PERFORMANCE MEASUREMENT | INSTRUCTIONAL SUPPORT SYSTEM | INTEGRATED MAINT INFO SYSTEM | INTEL COMP-AIDED TRNG TESTBEDS | INTELLIGENT TUTORING SYSTEMS | LOGISTICS COMMAND AND CONTROL | TRNG DECISIONS MODELING TECH | TRAINING EVALUATION |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| ANALYZE SYSTEM REQUIREMENTS | TRNG NEEDS ASSESSMENT | | | | | | | | | | | | | | | |
| | analyze situation | | | | | | ● | ● | | | | | | | | |
| | identify parameters | | | | ● | | | ● | | | | | | ● | | |
| | DEFINE/ANALYZE JOB PERFORMANCE RQTS | | | | | | | | | | | | | | | |
| | develop task listing | | ● | | | ● | | | | | | | | | ● | |
| | analyze job tasks | | ● | ● | | | | | | | | | | ● | | |
| | set target pop characteristics | | | | | | ● | | | | | | | | | |
| DEFINE EDUCATION & TRAINING RQTS | SELECT TASKS REQUIRING TRNG | | ● | | | ● | | ● | | | | | | | | ● |
| | DETERMINE STUDENT PREREQUISITES | | | | | | ● | | | | | | | | | |
| | SELECT APPROPRIATE TRNG SETTING | | | | | | | ● | | | | | | | ● | |
| | FORECAST RESOURCE/LOGISTIC RQTS | | ● | | ● | | | | | | | | | | ● | |
| DEVELOP OBJECTIVES & TESTS | DEVELOP OBJECTIVES | ● | ● | ● | | | | | | | | | | | | |
| | DEVELOP TESTS | ● | ● | | | ● | | | | | | | | | | ● |
| | DEVELOP JOB PERF TESTING METHODS | | | | | | | | ● | | | | | | | ● |

● DENOTES THAT A PROJECT ADDS TO THE TECHNOLOGY OR KNOWLEDGE BASE OF A PROCESS

(Figure 6 continued)

| INSTRUCTIONAL SYSTEM DEVELOPMENT | PROCESSES | ADV INSTRUCTIONAL DESIGN ADVISOR | ADVANCED OJT SYSTEM/BTS | BASIC JOB SKILLS | CBT SELECTION ADVISOR | CODAP | FUNDAMENTAL SKILLS TRAINING | JOB-AIDED/TRNG ALLOCATION TECH | JOB PERFORMANCE MEASUREMENT | INSTRUCTIONAL SUPPORT SYSTEM | INTEGRATED MAINT INFO SYSTEM | INTEL COMP-AIDED TRNG TESTBEDS | INTELLIGENT TUTORING SYSTEMS | LOGISTICS COMMAND AND CONTROL | TRNG DECISIONS MODELING TECH | TRAINING EVALUATION |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| PLAN, DEVELOP & VALIDATE INSTRUCTION | PLAN SEQUENCE OF INSTRUCTION | ● | | | | | | | | | | | | | | |
| | SELECT INSTRUCTIONAL METHOD | | | | | | | | | | | | | | | |
| | eval alternative instr methods | ● | | | ● | | | | | | | | | | | ● |
| | select instructional method | ● | | | | | | | | | | | | | | |
| | establish detailed course design | ● | | ● | | | | | | | | | | | | |
| | SELECT INSTRUCTIONAL MEDIA | | | | | | | | | | | | | | | |
| | evaluate candidate media | | | | ● | | | | | | | | | | | |
| | select instructional media | | | | ● | | | | | | | | | | | |
| | develop system specifications | | | | ● | | | | | | | | | | | |
| | DETERMINE RESOURCE AND FUNDING REQTS | | ● | | ● | | | | | | | | | | ● | |
| | DEVELOP INSTRUCTIONAL MATERIALS | | | | | | | | | | | | | | | |
| | author instructional material | ● | ● | ● | | | | | | ● | ● | ● | | | | |
| | produce instructional material | ● | ● | ● | | | | | | ● | | ● | | | | |
| | VALIDATE INSTRUCTIONAL MATERIALS | | | | | | | | | | | | | | | |
| | review courseware prototype | | | | | | | | | | | | | | | |
| | individual & small group tryouts | | | | | | | | | | | | | | | |
| | VALIDATE COMPLETE SYSTEM | | | | | | | | ● | | | | | | | ● |

● DENOTES THAT A PROJECT ADDS TO THE TECHNOLOGY OR KNOWLEDGE BASE OF PROCESS

(Figure 6 continued)

| INSTRUCTIONAL SYSTEM DEVELOPMENT | PROCESSES | ADV INSTRUCTIONAL DESIGN ADVISOR | ADVANCED OJT SYSTEM/BTS | BASIC JOB SKILLS | CBT SELECTION ADVISOR | CODAP | FUNDAMENTAL SKILLS TRAINING | JOB-AIDED/TRNG ALLOCATION TECH | JOB PERFORMANCE MEASUREMENT | INSTRUCTIONAL SUPPORT SYSTEM | INTEGRATED MAINT INFO SYSTEM | INTEL COMP-AIDED TRNG TESTBEDS | INTELLIGENT TUTORING SYSTEMS | LOGISTICS COMMAND AND CONTROL | TRNG DECISIONS MODELING TECH | TRAINING EVALUATION |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| CONDUCT & EVALUATE | DELIVER INSTRUCTION | ● | ● | ● | | | | | | ● | | ● | ● | ● | | |
| | SUPPORT INSTRUCTION | | | | | | | | | | | | | | | |
| | schedule students | | ● | | | | | | | ● | | | | | | |
| | schedule resources | | ● | | | | | | | ● | | | | | | |
| | track student progress | | ● | ● | | | | | | ● | | | | | | |
| | manage ind training rqts | | ● | | | | | | | | | | | | | |
| | maintain & update instr system | | ● | | | ● | | | | | ● | | | | | |
| | EVALUATE INSTRUCTION | | | | | | | | | | | | | | | |
| | evaluate internal validity | | ● | | | | | | | | | | | | | ● |
| | evaluate external validity | | ● | | | | | | ● | | | | | | | |
| | measure utility & cost-benefit | | | | | | | | | | | | | | | |

● DENOTES THAT A PROJECT ADDS TO THE TECHNOLOGY OR KNOWLEDGE BASE OF A PROCESS

The results of this matching process are discussed in the remainder of this section, focusing on each of the processes listed as deficient in Table 7 and their relationship to AF training technology research.

The ISD process entitled "select tasks requiring training" was implicated as being deficient several times in the analysis of training system problems. Figure 6 indicates that four technologies (i.e., projects) enhance the knowledge or technology base for the selection of training requirements, including the Advanced OJT System (AOTS)/BTS, the Comprehensive Occupational Data Analysis Package (CODAP), Job-Aiding/Training Allocation Technologies (JATAT), and Training Evaluation. Each of these technologies is intended to enhance the training requirements selection process in a slightly different manner. Unfortunately, the analytic framework, as it is currently defined, does not distinguish between these subtle differences. Even if it could, the level of specificity of the data would preclude a more in depth comparison of needs and technologies. Suffice it to say that, based on the interview data, resources for accurately selecting training tasks need to exist at all levels of the training system. This will enable training managers to tailor training requirements to their particular situations.

Deficiencies in the processes for "selecting appropriate training settings" and "forecasting resource logistic requirements" appear to be closely related. The reason being that forecasting resource and logistic requirements was an important step in determining appropriate training settings. In other words, the appropriateness of a training setting was largely dependent upon the adequacy of its resources. Three of the training technologies, the AOTS, CBT Selection Advisor, and the Training Decisions Modeling Technologies (TMDT), provide a capability for forecasting resource and logistic requirements. However, only one of these technologies, the TDMT, goes the additional step and enhances the process for selecting appropriate training settings based on the forecasted resource and logistic requirements.

At a very broad level, the process for "selecting instructional methods" was implicated by two of the apparent training system problems. Several technologies, including the Advanced Instructional Design Advisor (AIDA), Basic Job Skills (BJS), CBT Selection Advisor, and Training Evaluation, address some, if not all, aspects of this deficiency. Unfortunately, as previously stated, researchers could not discern from the data which of the subprocesses needed improvement, and therefore, it is unclear which technologies truly address the deficiency. The only exception to this would be AIDA which addresses each aspect of method selection.

The CBT Selection Advisor is the only technology which addresses the deficiencies in "selecting instructional media". It would appear that this technology fully addresses the deficiencies in media selection, but appearances can be

deceiving. The overlaps shown in Figure 6 simply indicate that a technology enhances the same type of functions which have been identified as deficient. A closer examination of the situation reveals that the technology in question is intended to enhance media selection and use within one specific context -- computer-based training. The deficiencies indicated by the Phase I research appear to encompass media selection at a more general level; that is, it is not content specific. Training developers and manager need help identifying training media, CBT or other, suitable to the unit-level environment. Whether or not the CBT Selection Advisor can be adapted for media selection in general is unknown.

Deficiencies in the "determination of resource and funding requirements" for IVD instruction contributed to the poor implementation of this category of instruction at units. The AOTS, CBT Selection Advisor, and TDMT are possible solutions to this deficiency, however. These technologies would enable training developers to determine the exact resource and funding requirements necessary to support their instruction prior to actually implementing it.

Training delivery is the most salient process in the instructional system and is the culmination of all the other processes. It is, if you will, "where the rubber meets the road." Of the fifteen training technologies of concern in this study, almost half (i.e., seven) of them are intended to enhance the delivery of instruction. They do so through a variety of computer-based and intelligent tutoring systems. However, deficiencies which appear in the delivery process are often the result of deficiencies in other processes. While the interview data suggests that the delivery of instruction needs improvement to overcome problems in the unit-level environment such as limited training time, it is likely that the delivery problem would be solved if other processes (e.g., selection of instructional media) were improved.

All but one of the processes within the instructional support area were identified as deficient. These processes, along with instructional delivery and evaluation, are perhaps the most germane to operational units (as opposed to the training planning, programming and development functions which typically occur outside the units themselves). According to the data collected at PACAF F-16 maintenance units, the scheduling of both resources (i.e., instructors) and students (i.e., for enroute training) was deficient. The AOTS/BTS and Instructional Support System (ISS) are intended to address this type of deficiency. In fact, the AOTS/BTS incorporates ISS technology into itself.

Deficiencies in the "management of individual training requirements" also degraded the instructional support capabilities of unit-level training. This situation is very much related to the problem surrounding "selection of tasks requiring training" and may, in fact, only be a consequence of this deficiency. In this case, however, training managers were unable or unwilling to tailor training requirements to the needs of individuals at a

job-site as opposed to the needs of an AF specialty or one of its shreds. The AOTS, once again purports to enhance the process for managing individual training requirements. It is also likely that the capabilities found in CODAP, JATAT, and Training Evaluation are applicable to this process (just as they are to "selection of tasks requiring training").

Instructional support also suffered from deficiencies in the "maintenance and update of the instructional system." More specifically, interviewees felt that training courses were not being updated or modified based on feedback from the field (via follow-up surveys, course critiques, and informal communications). Several technologies offer potential solutions to this problem by strengthening the feedback loop between the field and the course developers, instructors and administrators. These technologies include AOTS, CODAP, and the Integrated Maintenance Information System (IMIS). Whether or not the information provided by these technologies is actually used to update courses is a separate question beyond the scope of this research.

Finally, the deficiencies in the feedback mechanisms just described also indicate deficiencies in the process for "evaluating the external validity of instruction." The fact that some interviewees felt courses were not being updated to reflect the realities of the operational environment also indicates that the external validity of some courses is questionable (at least in terms of their face validity). The AOTS and JPM technologies are intended to improve this process in the training system. The information generated by these technologies should allow course developers to evaluate the degree to which their courses teach the skills and knowledges relevant to the work environment including appropriateness of course content and transfer of training.

## D. Discussion of Matching Process

At first glance, there would appear to be no apparent gaps in the AF training technology research. Each of the ISD processes that researchers found to be deficient in the unit-level training system for PACAF F-16 maintenance units are in some way addressed by a training technology. The only area which may be overlooked is that of training media selection. Currently, only one technology, the CBT Selection Advisor, addresses this problem, but it does so from a CBT perspective only.

The training system needs and technology match also reveals areas where technologies are focused but which were not implicated by the data as being deficient. However, this does not mean that the technologies are "misguided." First of all, this study was limited to PACAF F-16 maintenance units. The training technologies, on the other hand, are being developed for a broader AF application. Second, while only certain processes were implicated as deficient at the unit level, improvements made to any of the processes are potentially beneficial to unit-level training.

Finally, the data collection instruments used in this study were not based on the analytic framework as seen in figures 4, 5, and 6. Consequently, there is some degree of error in the results presented here.

Moreover, the framework presented in this report has a number of limitations which should also be acknowledged. It was developed specifically for describing and relating training technologies to training system needs at a very basic level; that is, it merely shows where the functions of training technologies match deficiencies in the training system. The framework does not, for instance, specify the theoretical principles, procedures, and rules for developing and operationalizing constructs, and for analyzing and interpreting data (see Ostroff & Ford, 1989). Nor does the framework explicitly address the issue of training domains; i.e., the specific contextual areas with which training technologies or deficits are associated, such as aircrew, maintenance, and the like.

Nevertheless, the analytic framework represents an important, although preliminary step toward development of a systematic process for identifying and describing training system needs, cataloguing training technology functions, and relating the two. Future work in this area would greatly benefit from the theoretical developments found in training needs assessment research. Ostroff and Ford (1989), for example, presented a model of needs assessment based on a levels perspective. According to this model, training needs occur at three levels: organizational, subunit, and individual. Each of these levels of analysis has implications for construct development, operationalization, and interpretation. It is likely that these concepts would also be applicable to training systems needs assessment should research continue in this area.

In summary, the data indicates that training system needs are being addressed by training technologies. These relationships, however, deserve a more in depth examination. Researchers must go beyond the question of whether or not technologies are functionally matched to deficiencies. They must examine issues such as the degree to which a technology meets a need, the seriousness of a training system need, and the context surrounding the deficiencies. Such an examination would reveal specific areas where training technologies could be focused in order to increase their applicability to unit-level training. Before this can take place, researchers must first advance the framework which has guided the analysis described in this chapter.

# Appendix G

# Survey Respondents' and Interviewees' Demographics

# Survey MAJCOM and Unit of Assignment
## *(Training Managers)*

| | AFLC | AFSC | SPA | ATC | AU | ESC | MAC | SAC | TAC | COS | AFCA | AFIC | MPC | MWRA | OSP | OTHER | TOTAL |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| MAINT | 3 | 4 | | | | 1 | 17 | 19 | 14 | | | | | | | 9 | 67 |
| A/V | | | | | | | 1 | | | | | | | 1 | | | 2 |
| CHAP | | | | | 1 | | | | | | | | | | | | 1 |
| CE | 1 | 1 | | | 1 | | 3 | 5 | 3 | | | | | | | 7 | 21 |
| COMM | 1 | | | | 1 | | 4 | 6 | 3 | | 2 | | | | | 9 | 26 |
| COMP | | | | | | | 2 | 5 | | | | | | | | 2 | 9 |
| EDUC | | 1 | | 2 | 5 | | | 2 | 1 | | | | | | | | 11 |
| FLY | | 1 | | 1 | | | 5 | 3 | 2 | | | 1 | | | | | 13 |
| INFO | | | | | | | | | 1 | | | | 1 | | | | 2 |
| MED | 1 | | | | 1 | | 1 | 4 | 1 | 1 | | | | | | | 9 |
| MISL | | | | | | | | 6 | | | | | | | | | 6 |
| PERS | | | | 1 | 2 | | 3 | 1 | 3 | | | | | | | 3 | 13 |
| SECPOL | 1 | 1 | 1 | 1 | 1 | | | 5 | | | | | | | 1 | 4 | 15 |
| SVC | | | | | 1 | | 2 | 3 | 2 | | | | | | | 4 | 12 |
| SOCAC | | | | | | | | 1 | | | | | | | | | 1 |
| SUP | | 1 | | | | | 2 | 7 | 2 | | | | | | | 4 | 16 |
| TRANS | | | | | | | 6 | 3 | 2 | | | | | | | 4 | 15 |
| TRNG | 3 | 4 | | 10 | 1 | | 12 | 12 | 18 | | | | | | | 16 | 76 |
| WEA | | | | | | | 1 | | | | | | | | | 1 | 2 |
| OTHER | | 1 | | | 5 | 2 | 6 | 7 | 10 | | | | | | | 52 | 83 |
| TOTAL | 10 | 14 | 1 | 15 | 19 | 3 | 65 | 89 | 62 | 1 | 2 | 1 | 1 | 1 | 1 | 115 | 400 |

# Survey MAJCOM and Unit of Assignment *(Trainers)*

| | AFLC | AFSC | ATC | AU | ESC | MAC | SAC | TAC | AFCA | AFDW | AFIC | AFIA | LSC | MWRA | OMS | OSP | OSI | OTEC | OTHER | TOTAL |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| MAINT | 16 | 16 | 1 | | 2 | 87 | 66 | 91 | | | | 1 | | | | | | | 93 | 373 |
| A/V | | | | | | 1 | | | | | | | | | | | | | 1 | 2 |
| CHAP | | | | | | | 1 | | | | | | | | | | | | 1 | 2 |
| CE | 3 | 10 | 2 | 4 | 1 | 13 | 11 | 27 | | | | | | | | | | | 25 | 96 |
| COMM | 11 | 9 | 1 | 4 | 11 | 7 | 19 | 16 | 16 | | | | | | | | | | 34 | 128 |
| COMP | 1 | 3 | | | | | 6 | | 1 | | | | | | | | | | 4 | 15 |
| EDUC | | | 1 | 4 | | 1 | | 1 | | 1 | | | | | | | | | 2 | 10 |
| FLY | 1 | | | | 5 | 9 | | 11 | | | | | | | | | | | 11 | 37 |
| INFO | 1 | 3 | | 3 | 1 | 3 | 2 | 8 | 1 | | 2 | | | | 1 | | | | 10 | 35 |
| LEGAL | 1 | | | | | | 1 | | | | | | 2 | | | | | | 3 | 7 |
| MPR | | | | 1 | | | | 1 | | | | | | | | | | | 1 | 3 |
| MED | 4 | 5 | 2 | 3 | | 5 | 12 | 6 | | | | | | | 3 | | | | 23 | 63 |
| MISSL | | | | | | | 35 | 2 | | | | | | | | | | | | 37 |
| MWR | | | | | | | | | 1 | | | | | 1 | | | | | 1 | 3 |
| PERS | | | | 2 | | 2 | 5 | 2 | | | | | | | | | | | 7 | 18 |
| PA | | | | | | | 1 | | | | | | | | | | | | | 1 |
| SAFETY | | | | 1 | | 1 | | | | | | | | | | | | | 1 | 3 |
| SECPOL | 4 | 2 | 2 | 2 | 1 | 7 | 43 | 2 | | | | | | | | 12 | | | 22 | 97 |
| SVC | | 1 | | 1 | 1 | | 6 | 3 | | | | | | | | | | | 4 | 16 |
| SOCAC | | 1 | | | | 1 | 1 | | | | | | | | | | | | | 3 |
| SUP | | 4 | | 1 | | 5 | 15 | 16 | | | 1 | | | | | | | | 19 | 61 |
| TRANS | 1 | 7 | 1 | | | 19 | 8 | 1 | | | | | | | | | | | 10 | 47 |
| TRNG | | 1 | 3 | | | 1 | | 4 | | | | | | | 1 | | | | 9 | 19 |
| WEA | | | | | | | 3 | | | | | | | | | | | | | 3 |
| OTHER | 7 | 6 | 7 | 8 | 28 | 12 | 37 | 34 | 4 | 2 | 1 | 3 | 1 | | | | 2 | 1 | 147 | 300 |
| TOTAL | 50 | 68 | 20 | 34 | 50 | 174 | 272 | 225 | 23 | 3 | 4 | 4 | 3 | 1 | 5 | 12 | 12 | 1 | 428 | 1379 |

# Survey MAJCOM and Unit of Assignment
## *(Trainees)*

| | AFLC | AFSC | SPA | ATC | AU | ESC | MAC | SAC | TAC | COS | AFCA | AFDW | AFIC | AFIA | LSC | MEA | MPC | MWR | OMS | OSP | OTEC | SE | AFA | OTH | TOT |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| MAINT | 3 | 26 | | | | | 74 | 58 | 94 | 1 | | | | | | | | | | | | | 1 | 74 | 331 |
| A/V | | | | | | | | | 2 | | 1 | | | | | | | | | | | | | 4 | 7 |
| AUDIT | | | | | | | | | 1 | | | | | | | | | | | | | | | | 1 |
| CHAP | | | 1 | 1 | 2 | | | | | | | | | | | | | | | | | | | 1 | 5 |
| CE | 2 | 5 | | 4 | 1 | | 22 | 28 | 17 | | | 1 | | | | | | | | | | | | 28 | 108 |
| COMM | 8 | 6 | | 2 | 2 | 19 | 11 | 19 | 16 | | 28 | | | 1 | | | | 1 | | | | | | 61 | 174 |
| COMP | | 1 | | | | | 5 | 2 | | 3 | | | | | | | | | | | 1 | | | 6 | 18 |
| EDUC | 3 | | | 2 | 4 | | | 2 | | | | | | | | | | | | | | | | 1 | 12 |
| FLY | 1 | 2 | | | | 5 | 14 | 4 | 7 | | | | | | | 1 | | | | | 1 | | | 10 | 45 |
| INFO | | 1 | | | 1 | 2 | 5 | 5 | 3 | | | | | | | | | | | | | | | 14 | 31 |
| LEGAL | | | | | | 1 | | | | | | | | | 1 | | | | | | | | | | 2 |
| MED | 4 | 9 | | 4 | 1 | | 5 | 20 | 12 | | | 1 | | 1 | | | | | 5 | | | 1 | | 11 | 74 |
| MISSL | | | | | | | | 31 | 1 | | | | | | | | | | | | | | | | 32 |
| MWR | 1 | | | | | | 1 | 1 | 2 | | | | | | | | | | | | | | | | 5 |
| PERS | 3 | | | 1 | | 1 | 1 | 8 | 2 | | | | | | | | 1 | | | | | | | 5 | 22 |
| SAFETY | | 1 | | | | | | 1 | 1 | | | | | | | | | | | | | | | | 3 |
| SECPOL | 4 | 5 | | 1 | 3 | | 9 | 46 | 3 | | | 1 | | | | | | | | 21 | | | | 23 | 116 |
| SVC | 1 | 3 | | | 1 | | 2 | 8 | 3 | | | 1 | | | | | | | | | | | | 5 | 24 |
| SOCAC | | | | | | | 1 | | 1 | | | | | | | | | | | | | | | | 2 |
| SUP | 3 | 6 | | 3 | 1 | 1 | 18 | 31 | 20 | | | | | | | | | | | | | | | 29 | 112 |
| TRANS | 5 | 5 | | | | | 36 | 10 | 5 | | | | | | | | | | | | | | | 20 | 81 |
| TRNG | | 1 | | 1 | | | | 3 | 3 | | | | | | | | | | | | | | | 1 | 9 |
| WEA | | | | | | | 1 | 1 | | | | | | | | | | | | | | | | 1 | 3 |
| OTHER | 5 | 8 | | 5 | 8 | 27 | 21 | 58 | 45 | | 1 | | 3 | 1 | | | | | | | | | | 172 | 372 |
| TOTAL | 43 | 79 | 1 | 24 | 24 | 56 | 226 | 336 | 238 | 4 | 30 | 4 | 3 | 3 | 1 | 1 | 1 | 1 | 5 | 21 | 2 | 1 | 1 | 484 | 1589 |

# Interviewees By Base

| | POPE | LANGLEY | OFFUTT | SCOTT | MCCONNELL | NELLIS | TOTAL |
|---|---|---|---|---|---|---|---|
| TRNG MGRS | 4 | 6 | 7 | 7 | 7 | 7 | 38 |
| TRAINERS | 7 | 6 | 6 | 7 | 7 | 7 | 40 |
| TRAINEES | 7 | 5 | 8 | 7 | 7 | 6 | 40 |
| TOTAL | 18 | 17 | 21 | 21 | 21 | 20 | 118 |

# Interviewees' MAJCOM/Unit of Assignment

| TRNG MGRS | CIV ENG | MAINT | MEDICAL | MSQ | PERS | SEC POL | SUPPLY | TRANS | OTHER | TOTAL |
|---|---|---|---|---|---|---|---|---|---|---|
| MAC | 1 | 1 | 2 | 1 | 1 | 2 | 3 | 0 | 0 | 11 |
| SAC | 2 | 4 | 2 | 2 | 0 | 2 | 0 | 2 | 0 | 14 |
| TAC | 3 | 2 | 3 | 2 | 0 | 1 | 2 | 0 | 0 | 13 |
| SUB-TOTAL | 6 | 7 | 7 | 5 | 1 | 5 | 5 | 2 | 0 | 38 |
| | | | | | | | | | | |
| TRAINERS | | | | | | | | | | |
| MAC | 2 | 3 | 2 | 0 | 1 | 3 | 2 | 0 | 1 | 14 |
| SAC | 3 | 3 | 2 | 0 | 2 | 2 | 1 | 2 | 0 | 15 |
| TAC | 1 | 2 | 3 | 1 | 0 | 1 | 1 | 0 | 2 | 11 |
| SUB-TOTAL | 6 | 8 | 7 | 1 | 3 | 6 | 4 | 2 | 3 | 40 |
| | | | | | | | | | | |
| TRAINEES | | | | | | | | | | |
| MAC | 3 | 2 | 2 | 1 | 0 | 2 | 3 | 0 | 1 | 14 |
| SAC | 2 | 2 | 3 | 0 | 2 | 2 | 1 | 1 | 0 | 13 |
| TAC | 2 | 2 | 2 | 2 | 1 | 2 | 2 | 0 | 0 | 13 |
| SUB-TOTAL | 7 | 6 | 7 | 3 | 3 | 6 | 6 | 1 | 1 | 40 |
| | | | | | | | | | | |
| TOTAL | 19 | 21 | 21 | 9 | 7 | 17 | 15 | 5 | 4 | 118 |

# Appendix H

# Science and Technology Investment Strategy Checklist Guide

# SCIENCE & TECHNOLOGY INVESTMENT STRATEGY CHECKLIST GUIDE

***Prepared For:*** Technical Training Research Division
Human Resources Directorate of the
Armstrong Laboratory
Brooks AFB, TX 78235-5352

***Prepared By:*** HAY Systems, Inc.
4301 North Fairfax Drive
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Arlington, VA 22203-1633

## SCIENCE AND TECHNOLOGY INVESTMENT STRATEGY CHECKLIST GUIDE

This Guide provides "how-to" guidance for accomplishing the Science and Technology (S&T) Investment Strategy Checklist. The checklist is intended to structure the research process to ensure that, at a minimum, certain considerations affecting selection of a successful S&T investment strategy are addressed.

The S&T Investment Strategy Checklist is designed to be used by all members of the research team throughout the life of the research project. It should be updated continuously as the research effort dictates, and critically reviewed at periodic team meetings chaired by the project director. Individuals must keep in mind that actions they take may affect actions being taken by others, thus, communication between team members throughout the process is critically important.

The checklist is not intended as a repository for all research data/information. Rather, it is a means to ensure all appropriate actions are anticipated and accomplished, with references to where pertinent data/information can be found.

Lessons learned in the pursuit of a relatively recent, large-scale research and development project are particularly pertinent to efforts of this nature. In the conduct of this project, it was determined that, to be successful, one should:

- address recognized, real, and substantial needs
- with realistic objectives

- using feasible enabling technologies
- applied in iterative, rapid prototyping, innovative approaches
- that make frequent use of concrete demonstrations
- with customer participation and high-level customer support
- in a risk-tolerant research and development environment
- with competent people
- organized into a development team with appropriate leadership

It would be beneficial to use these lessons learned as guiding principles as the attached checklist is used in developing an investment strategy.

The checklist is organized by the following categories and sub-categories:

1. **THE PROBLEM**
   - 1.01 Problem/Opportunity Identification
   - 1.02 Characteristics of the Product(s) to be Produced
   - 1.03 Externally Generated Priorities
   - 1.04 Internally Generated Priorities
2. **THE TECHNOLOGIES**
   - 2.01 Identification of Technologies
   - 2.02 Opportunity Costs
   - 2.03 Trade-off Studies
   - 2.04 Risk Assessment
   - 2.05 Software Supportability
   - 2.06 Hardware Supportability
   - 2.07 User Training
   - 2.08 Flexibility
3. **PROGRAM PLANNING**
   - 3.01 Coordination/Interface
   - 3.02 Funding
   - 3.03 Staffing
   - 3.04 Facilities
   - 3.05 Time-line
   - 3.06 Contracting (if used)
4. **TEST AND EVALUATION**
   - 4.01 System Performance
   - 4.02 User Acceptability

5. **IMPLEMENTATION/DEPLOYMENT PLANNING**

5.01 Cost-Effectiveness Analysis for Deployment

5.02 Implementation Management

5.02 Implementation Resources

6. **DOCUMENTATION & FOLLOW-UP**

6.01 Documentation of Development Process

6.02 Documentation for Technology

6.03 Follow-up

The Reference Document contains a detailed discussion of each of the categories and subcategory of questions. This guide describes the structure of the checklist and the intended use of each column. The checklist is structured as follows:

<u>ITEM#</u> <u>ITEM</u> <u>ISSUES</u> <u>ACTION</u> <u>OPR</u> <u>SUSPENSE</u> <u>STATUS</u>

Although an attempt has been made to array the categories in a generally sequential manner for most processes, there will be times when it makes perfectly logical sense to address categories or issues simultaneously, or seemingly "out of sequence". For example, information needed to respond to subcategory 3.02 (Funding) might be readily available, whereas that required to respond to subcategory 2.02 (Opportunity Costs) may very well take more time to develop or obtain.

Following each category/subcategory is a series of questions to be addressed. These preset questions are designed to address a generic S&T investment strategy. Those which do not apply to a particular project should be annotated with "N/A" in the "Issues" column. Other questions can be added to tailor the analysis to the specific situation or requirements.

Note that all questions are structured to illicit a "yes" or "no" response. Dependent upon the response, issues may surface which must be addressed before the investment strategy is pursued further. An issue is a potential or actual deficiency identified at any time in the process that, to a greater or lesser degree, would affect successful pursuit of the investment strategy. For example, if the answer is "yes" to question 3.02.03 (Are allocated funds adequate?), no issue exists and a notation should be made under the "Issues" column which would provide an audit trail to the rationale or documentation which supports the adequacy determination. However, if the answer is

"no," this issue may be a "show-stopper" if not resolved, and an appropriate statement of the issue should be place in the "Issues" column. Only those questions which are considered not appropriate for this particular review should be accompanied with "N/A" in the "Issues" column. All other questions should be acompanied with an appropriate annotation in the "Issues" column, whether answered "yes or "no". Although the use of a "do not know" response should be minimized, it is recognized that, at times, this may be the only appropriate response. In this case, it is particularly important that a clear statement of the issues(s) be documented, and immediate action be taken to either resolve the issue, or assign action to someone to resolve it.

For those issues identified, actions are required in efforts to satisfactorily resolve them. These actions should be documented in the "Action"column. In the above example, an appropriate action may be to "Obtain adequate funds," Request adequate funds," or "Reprogram funds from a lower priority project."

For those issues for which action is required, a person or office should be assigned responsibility for accomplishing the action, and documented in the "OPR" column. Although there may be legitimate reasons for reflecting more than one person or office as being responsible, such practice should be avoided as much as possible. Some<u>one</u> with the proper authority should be assigned the overall responsibility for resolving the issue, and be held accountable.

In order to keep a project moving and on schedule, demanding (but realistic) "Suspense" dates for resolution of issues should be established and documented. Individual suspenses must conform to the project timeline(s) addressed in subcategory 3.05 (Timeline). If a suspense is missed, or anticipated to be missed, the OPR should document the reason under the "Status" column, and a new suspense date should be assigned by the Project Director and indicated in the "Suspense" column.

"Status" codes can take many forms. "Open" and "closed" may be sufficient for some projects, but a wider array may be more appropriate for others. Any coding scheme should work as long as terms are well defined. If not clearly defined, terms such as "Open" and "Pending" may have a different meaning for some people, but the same for others.

# Appendix I

# Science and Technology Investment Strategy Checklist

# SCIENCE & TECHNOLOGY INVESTMENT STRATEGY CHECKLIST

*Prepared For:* Technical Training Research Division
Human Resources Directorate of the
Armstrong Laboratory
Brooks AFB, TX 78235-5352

*Prepared By:* HAY Systems, Inc.
4301 North Fairfax Drive
Suite 500
Arlington, VA 22203-1633

# Science and Technology Investment Strategy Checklist

| Item# | Item | Issues | Action | Opr. | Suspense | Status |
|---|---|---|---|---|---|---|
| *1.* | ***THE PROBLEM*** | | | | | |
| 1.01 | Problem/Opportunity Identification: | | | | | |
| 1.01.01 | Has the reason for this investigation been identified and documented? | | | | | |
| 1.01.02 | Have the specific needs of the training environment to be investigated been identified? | | | | | |
| 1.01.03 | Have the specific aspects of the training environment to be investigated been identified? | | | | | |
| 1.01.04 | Has a research strategy been developed? | | | | | |
| 1.01.04.01 | Have research methods, solutions, or options been selected to satisfy the requirements? | | | | | |

# Science and Technology Investment Strategy Checklist

| Item# | Item | Issues | Action | Opr. | Suspense | Status |
|---|---|---|---|---|---|---|
| 1.01.04.02 | Have assumptions been developed, documented, and coordinated? | | | | | |
| 1.01.04.03 | Have problems in the research approach been identified? | | | | | |
| 1.01.05 | Has the research identified specific areas or problems where application of technology may be appropriate? | | | | | |
| 1.01.06 | Has a plan of action been developed? | | | | | |
| 1.01.07 | Will the findings of the plan of action lead to technology required? | | | | | |
| 1.01.08 | | | | | | |

# Science and Technology Investment Strategy Checklist

| Item# | Item | Issues | Action | Opr. | Suspense | Status |
|---|---|---|---|---|---|---|
| 1.02 | <u>Characteristics of the Product(s) to be Produced:</u> | | | | | |
| 1.02.01 | Have the physical characteristics of the product(s) to be produced been identified? | | | | | |
| 1.02.02 | Have the functional characteristics of the product(s) to be produced been identified? | | | | | |
| 1.02.03 | | | | | | |

# Science and Technology Investment Strategy Checklist

| Item# | Item | Issues | Action | Opr. | Suspense | Status |
|---|---|---|---|---|---|---|
| 1.03 | <u>Externally Generated Priorities</u>: | | | | | |
| 1.03.01 | Have priorities for research been established by "external" activities (e.g., Air Staff, MAJCOM, user)? | | | | | |
| 1.03.01.01 | Have the above priorities been accommodated by the research plan and approach? | | | | | |
| 1.03.01.02 | If the above priorities have not been accommodated, has this been discussed with the official who established the priorities? | | | | | |
| 1.03.01.03 | Does that official agree with your "re-prioritization?" | | | | | |
| 1.03.0? | At least annually, have you checked with these external activities to reconfirm their priorities? | | | | | |
| 1.03.03 | | | | | | |

# Science and Technology Investment Strategy Checklist

| Item# | Item | Issues | Action | Opr. | Suspense | Status |
|---|---|---|---|---|---|---|
| 1.04 | <u>Internally Generated Priorities:</u> | | | | | |
| 1.04.01 | Is there clear rationale for internally generated priorities? | | | | | |
| 1.04.02 | Are the internally generated priorities compatible with the externally generated priorities? | | | | | |
| 1.04.03 | Is there external oversight for internally generated priorities? | | | | | |
| 1.04.04 | Can (will) your agency commit to the project and its expected time-line? | | | | | |
| 1.04.05 | | | | | | |

# SCIENCE AND TECHNOLOGY INVESTMENT STRATEGY CHECKLIST

| *Item#* | *Item* | *Issues* | *Action* | *Opr.* | *Suspense* | *Status* |
|---|---|---|---|---|---|---|
| **2.** | ***THE TECHNOLOGIES*** | | | | | |
| 2.01 | Identification of Technologies: | | | | | |
| 2.01.01 | Have the characteristics of the needed technologies been identified? | | | | | |
| 2.01.02 | Was a market survey performed to identify viable commercial products that best satisfy this requirement? | | | | | |
| 2.01.03 | Has a literature search been conducted to determine what technological capabilities are available from industry? | | | | | |
| 2.01.04 | Can existing technology be modified or adapted to satisfy this requirement? | | | | | |

# Science and Technology Investment Strategy Checklist

| Item# | Item | Issues | Action | Opr. | Suspense | Status |
|---|---|---|---|---|---|---|
| 2.01.04.01 | Was a market survey performed to identify viable government-owned products that best satisfy this requirement? | | | | | |
| 2.01.04.02 | Has the investigation of currently available technology produced results? | | | | | |
| 2.01.05 | Has a literature search been conducted to determine what technological capabilities are forecasted by industry? | | | | | |
| 2.01.06 | Has the investigation of technology in development produced promising results? | | | | | |
| 2.01.07 | Are new technologies required to address the requirement? | | | | | |

# Science and Technology Investment Strategy Checklist

| Item# | Item | Issues | Action | Opr. | Suspense | Status |
|---|---|---|---|---|---|---|
| 2.01.08 | Is basic research required? | | | | | |
| 2.01.09 | | | | | | |

# Science and Technology Investment Strategy Checklist

| Item# | Item | Issues | Action | Opr. | Suspense | Status |
|---|---|---|---|---|---|---|
| 2.02 | Opportunity Costs: | | | | | |
| 2.02.01 | Are there other possibly relevant technologies that are not being considered or developed? | | | | | |
| 2.02.02 | Is there a cost associated with delaying this research? | | | | | |
| 2.02.03 | Can the benefits expected from this project be quantified? | | | | | |
| 2.02.03.01 | Can the benefits be expressed in terms of reduced life-cycle costs? | | | | | |
| 2.02.03.02 | Can the benefits be expressed in terms of reduced manhours/ manpower? | | | | | |

# Science and Technology Investment Strategy Checklist

| Item# | Item | Issues | Action | Opr. | Suspense | Status |
|---|---|---|---|---|---|---|
| 2.02.03.03 | Can the benefits be expressed in terms of increased productivity? | | | | | |
| 2.02.03.04 | Can the benefits be expressed in terms of reduced training costs? | | | | | |
| 2.02.03.05 | Can the benefits be expressed in terms of reduced training time? | | | | | |
| 2.02.03.06 | Can the benefits be expressed in terms of increased student achievement/performance? | | | | | |
| 2.02.04 | Have life-cycle cost estimates been prepared for the technology under consideration? | | | | | |
| 2.02.05 | Has the expected amortization period for the costs associated with the research been determined? | | | | | |

# Science and Technology Investment Strategy Checklist

| Item# | Item | Issues | Action | Opr. | Suspense | Status |
|---|---|---|---|---|---|---|
| 2.02.06 | Has expected return-on-investment been calculated? | | | | | |
| 2.02.07 | Does the technology provide a detectable and meaningful improvement over existing capabilities? | | | | | |
| 2.02.08 | | | | | | |

# SCIENCE AND TECHNOLOGY INVESTMENT STRATEGY CHECKLIST

| Item# | Item | Issues | Action | Opr. | Suspense | Status |
|---|---|---|---|---|---|---|
| 2.03 | <u>Trade-off Studies:</u> | | | | | |
| 2.03.01 | Has the cost of doing nothing been assessed? | | | | | |
| 2.03.02 | If alternatives are feasible, have their costs been calculated? | | | | | |
| 2.03.03 | If alternatives are feasible, has their effectiveness been determined or estimated? | | | | | |
| 2.03.03.01 | For each alternative, have levels of proficiency anticipated to be attained by the trainees been assessed/estimated? | | | | | |
| 2.03.04 | | | | | | |

# Science and Technology Investment Strategy Checklist

| Item# | Item | Issues | Action | Opr. | Suspense | Status |
|---|---|---|---|---|---|---|
| 2.04 | Risk Assessment: | | | | | |
| 2.04.01 | Is there the likelihood that the technology will not work as intended? | | | | | |
| 2.04.02 | Will the technology provide safety risks to the user? | | | | | |
| 2.04.03 | Will the technology be of uncertain reliability to the user? | | | | | |
| 2.04.04 | Is the technological risk high? | | | | | |
| 2.04.05 | Is there a risk that the user will not accept the product? | | | | | |
| 2.04.05.01 | At least annually, have you asked the user to verify and revalidate commitment to the project? | | | | | |

# SCIENCE AND TECHNOLOGY INVESTMENT STRATEGY CHECKLIST

| Item# | Item | Issues | Action | Opr. | Suspense | Status |
|---|---|---|---|---|---|---|
| 2.04.06 | | | | | | |

# SCIENCE AND TECHNOLOGY INVESTMENT STRATEGY CHECKLIST

| Item# | Item | Issues | Action | Opr. | Suspense | Status |
|---|---|---|---|---|---|---|
| 2.05 | <u>Software Supportability:</u> | | | | | |
| 2.05.01 | Will software be needed to support the technology? | | | | | |
| 2.05.02 | Are the programming language and software compatible with existing systems/hardware used by both the developing agency and the user(s)? | | | | | |
| 2.05.03 | Is the software mature and proven? | | | | | |
| 2.05.04 | Is the software maintainable for the life of the project? | | | | | |
| 2.05.04.01 | Have maintenance requirements been identified? | | | | | |

# Science and Technology Investment Strategy Checklist

| Item# | Item | Issues | Action | Opr. | Suspense | Status |
|---|---|---|---|---|---|---|
| 2.05.04.02 | Has a determination been made as to who will be responsible for maintaining the technical currency of the information presented by the software? | | | | | |
| 2.05.04.03 | For software developed by a contractor, will the software be owned by the user without proprietary restrictions? | | | | | |
| 2.05.04.04 | Have the costs of maintenance been estimated? | | | | | |
| 2.05.04.05 | Have maintenance manhours been estimated? | | | | | |
| 2.05.04.06 | Are maintenance manhours supportable with existing manpower? | | | | | |
| 2.05.05 | | | | | | |

# Science and Technology Investment Strategy Checklist

| Item# | Item | Issues | Action | Opr. | Suspense | Status |
|---|---|---|---|---|---|---|
| 2.06 | Hardware Supportability: | | | | | |
| 2.06.01 | Have needs for supporting hardware been identified? | | | | | |
| 2.06.02 | Will users' existing hardware be used? | | | | | |
| 2.06.03 | Is the hardware compatible with existing systems? | | | | | |
| 2.06.04 | Is the hardware mature and proven? | | | | | |
| 2.06.05 | Is the hardware maintainable for the life of the project? | | | | | |
| 2.06.05.01 | Is logistics support capability in place? | | | | | |
| 2.06.06 | | | | | | |

# Science and Technology Investment Strategy Checklist

| Item# | Item | Issues | Action | Opr. | Suspense | Status |
|---|---|---|---|---|---|---|
| 2.07 | <u>User Training:</u> | | | | | |
| 2.07.01 | Will users or trainers need special training to use the technology? | | | | | |
| 2.07.02 | Has user training been specified as a deliverable of this project? | | | | | |
| 2.07.03 | Has an OPR been designated to design/deliver the user training? | | | | | |

# Science and Technology Investment Strategy Checklist

| Item# | Item | Issues | Action | Opr. | Suspense | Status |
|---|---|---|---|---|---|---|
| 2.08 | <u>Flexibility:</u> | | | | | |
| 2.08.01 | Can the technology incorporate job-related technological updates (e.g., changes to equipment and/or procedures)? | | | | | |
| 2.08.01.01 | Are mechanisms available/in place to ensure timely notification of changes? | | | | | |
| 2.08.01.02 | Have methods and requirements for incorporating new data into the system been established? | | | | | |
| 2.08.01.03 | Has an OPR for implementing the changes been identified? | | | | | |
| 2.08.02 | Can the research be redirected or re-channelled at critical points if necessary? | | | | | |

# Science and Technology Investment Strategy Checklist

| Item# | Item | Issues | Action | Opr. | Suspense | Status |
|---|---|---|---|---|---|---|
| 2.08.03 | Can the program be transitioned from R&D to prototype development without complete redesign and/or redevelopment? | | | | | |
| 2.08.04 | | | | | | |

# SCIENCE AND TECHNOLOGY INVESTMENT STRATEGY CHECKLIST

| *Item#* | *Item* | *Issues* | *Action* | *Opr.* | *Suspense* | *Status* |
|---|---|---|---|---|---|---|
| ***3.*** | ***PROGRAM PLANNING*** | | | | | |
| 3.01 | Coordination/Interface | | | | | |
| 3.01.01 | Has formal contact been made with the user or user representative? | | | | | |
| 3.01.01.01 | Has the user or user representative agreed to the need for research? | | | | | |
| 3.01.01.02 | Has the user or user representative "bought into" the research approach? | | | | | |
| 3.01.01.03 | Has a user representative been identified as a focal point or participant on the research team? | | | | | |
| 3.01.02 | Have interdependencies with other projects been identified and incorporated into project schedules and plans? | | | | | |

# Science and Technology Investment Strategy Checklist

| Item# | Item | Issues | Action | Opr. | Suspense | Status |
|---|---|---|---|---|---|---|
| 3.01.03 | Will the technology interface with other types of training/ training devices? | | | | | |
| 3.01.04 | Has coordination been effected with other interested or affected agencies, e.g., ATC, AU, AFIT? | | | | | |
| 3.01.05 | Have potential operational impacts been identified? | | | | | |
| 3.01.05.01 | Will units possibly face temporary reduced readiness during implementation? | | | | | |
| 3.01.05.02 | Will operational resources (manpower, dollars, equipment) be impacted? | | | | | |
| 3.01.06 | Have potential operational impacts been discussed with appropriate operational officials? | | | | | |

# Science and Technology Investment Strategy Checklist

| Item# | Item | Issues | Action | Opr. | Suspense | Status |
|---|---|---|---|---|---|---|
| 3.01.07 | Have actions been taken to minimize potential operational impacts? | | | | | |
| 3.01.08 | | | | | | |

# Science and Technology Investment Strategy Checklist

| Item# | Item | Issues | Action | Opr. | Suspense | Status |
|---|---|---|---|---|---|---|
| 3.02 | <u>Funding</u>: | | | | | |
| 3.02.01 | Have funding source(s) been identified for this research? | | | | | |
| 3.02.02 | Have funds been allocated for this research? | | | | | |
| 3.02.03 | Are allocated funds adequate? | | | | | |
| 3.02.04 | If funds are not adequate, have steps been taken to request/obtain additional funding? | | | | | |
| 3.02.05 | | | | | | |

# Science and Technology Investment Strategy Checklist

| Item# | Item | Issues | Action | Opr. | Suspense | Status |
|---|---|---|---|---|---|---|
| 3.03 | <u>Staffing:</u> | | | | | |
| 3.03.01 | Has an accurate assessment of manpower requirements to accomplish in-house research been accomplished? | | | | | |
| 3.03.01.01 | Will increased manpower be required to support the research? | | | | | |
| 3.03.01.02 | Can increases be satisfied through realignment of existing manpower resources? | | | | | |
| 3.03.01.03 | Are potential user agencies willing to relinquish manpower resources on a temporary basis to support research efforts? | | | | | |
| 3.03.02 | Has a determination been made as to which parts of the research will be done in-house versus contracted out? | | | | | |

# Science and Technology Investment Strategy Checklist

| Item# | Item | Issues | Action | Opr. | Suspense | Status |
|---|---|---|---|---|---|---|
| 3.03.02.01 | Is it more cost effective to contract out the research, or portions thereof? | | | | | |
| 3.03.03 | Have in-house resources been identified to perform the research? | | | | | |
| 3.03.04 | Are personnel identified to perform the research adequately and appropriately skilled? | | | | | |
| 3.03.05 | Are the personnel needed to conduct the research available? | | | | | |
| 3.03.06 | Is the organizational placement and supervision of the research appropriate? | | | | | |
| 3.03.07 | | | | | | |

# Science and Technology Investment Strategy Checklist

| Item# | Item | Issues | Action | Opr. | Suspense | Status |
|---|---|---|---|---|---|---|
| 3.04 | <u>Facilities:</u> | | | | | |
| 3.04.01 | Are the facilities to conduct the research available? | | | | | |
| 3.04.02 | Are necessary supplies and equipment available? | | | | | |
| 3.04.03 | | | | | | |

# Science and Technology Investment Strategy Checklist

| Item# | Item | Issues | Action | Opr. | Suspense | Status |
|---|---|---|---|---|---|---|
| 3.05 | <u>Time-line</u>: | | | | | |
| 3.05.01 | Has a time-line been developed? | | | | | |
| 3.05.02 | Where interdependencies with other projects have been identified, have time-lines been synchronized? | | | | | |
| 3.05.03 | Is the time that is necessary for research, development, and testing congruent with users' expectations for availability? | | | | | |
| 3.05.04 | Does the time-line include the point at which you expect to move from R&D to prototype? | | | | | |
| 3.05.05 | | | | | | |

# Science and Technology Investment Strategy Checklist

| Item# | Item | Issues | Action | Opr. | Suspense | Status |
|---|---|---|---|---|---|---|
| 3.06 | <u>Contracting (if used):</u> | | | | | |
| 3.06.01 | If required, has a Request for Proposals been written? | | | | | |
| 3.06.02 | Has an appropriate Statement of Work been developed? | | | | | |
| 3.06.03 | Have the conditions of the contract, e.g., fixed price, cost plus, 8A set-aside, been established? | | | | | |
| 3.06.04 | Has a contractor been identified/selected to perform the research? | | | | | |
| 3.06.05 | Are provisions in place for contract management? | | | | | |
| 3.06.06 | Is the contract adequately funded? | | | | | |

# Science and Technology Investment Strategy Checklist

| Item# | Item | Issues | Action | Opr. | Suspense | Status |
|---|---|---|---|---|---|---|
| 3.06.07 | Are procedures in place for reacting to, and decision making concerning, options raised by the contractor(s)? | | | | | |
| 3.06.08 | | | | | | |

# Science and Technology Investment Strategy Checklist

| Item # | Item | Issues | Action | Opr. | Suspense | Status |
|---|---|---|---|---|---|---|
| 4. | ***TEST AND EVALUATION*** | | | | | |
| 4.01 | System Performance: | | | | | |
| 4.01.01 | Are there clear and exact specifications for how the technology is intended to operate? | | | | | |
| 4.01.02 | Have criteria been identified against which to test performance? | | | | | |
| 4.01.03 | Are a priori standards available for those criteria? | | | | | |
| 4.01.03.01 | If answer to 4.01.03 is "no," will the technology be compared with another technology, such as that currently used? | | | | | |
| 4.01.04 | Have methodologies for initial test(s) been determined? | | | | | |

# SCIENCE AND TECHNOLOGY INVESTMENT STRATEGY CHECKLIST

| Item # | Item | Issues | Action | Opr. | Suspense | Status |
|---|---|---|---|---|---|---|
| 4.01.05 | Have "typical users" been identified to participate in the initial test(s)? | | | | | |
| 4.01.06 | Has initial testing shown that the technology operates as expected, and is compatible with normal user capabilities? (If "no," return to development phases.) | | | | | |
| 4.01.07 | Have appropriate methodologies for an initial field trial (or other procedure to test efficacy) been selected? | | | | | |
| 4.01.08 | Has a location(s) for an initial field trial been selected, contacted, and permission obtained for conducting the test? | | | | | |
| 4.01.09 | Will a large-scale field trial be needed to test for user acceptability, deployment within field conditions, and/or reliability of performance across time and adverse contexts? | | | | | |

# Science and Technology Investment Strategy Checklist

| Item# | Item | Issues | Action | Opr. | Suspense | Status |
|---|---|---|---|---|---|---|
| 4.01.10 | Is appropriate methodological expertise available for testing the efficacy of technical performance and the effectiveness of the technology within field conditions? | | | | | |
| 4.01.11 | | | | | | |

# Science and Technology Investment Strategy Checklist

| Item# | Item | Issues | Action | Opr. | Suspense | Status |
| --- | --- | --- | --- | --- | --- | --- |
| 4.02 | <u>User Acceptability:</u> | | | | | |
| 4.02.01 | Have users' specifications and criteria for acceptable performance been identified? | | | | | |
| 4.02.02 | Have decisions been made on when user acceptability will enter into testing and evaluation, e.g., in the lab, in initial field tests, in larger-scale trials? | | | | | |
| 4.02.03 | Have appropriate methodologies been selected for determining user acceptability? | | | | | |
| 4.02.04 | Is appropriate methodological expertise available for evaluating user acceptability? | | | | | |
| 4.02.05 | | | | | | |

# SCIENCE AND TECHNOLOGY INVESTMENT STRATEGY CHECKLIST

| Item# | Item | Issues | Action | Opr. | Suspense | Status |
|---|---|---|---|---|---|---|
| 5. | ***IMPLEMENTATION/DEPLOYMENT PLANNING*** | | | | | |
| 5.01 | <u>Cost-Effectiveness Analysis for Deployment:</u> | | | | | |
| 5.01.01 | Has the production cost per unit of the technology been determined for potential large-scale deployment? | | | | | |
| 5.01.02 | Has the average effectiveness of the technology been determined under "real world" conditions? | | | | | |
| 5.01.03 | Have the resources needed for effective large-scale implementation been identified? | | | | | |
| 5.01.04 | Does the increase in average effectiveness justify the cost of production and deployment of the technology? | | | | | |
| 5.01.05 | | | | | | |

# Science and Technology Investment Strategy Checklist

| Item# | Item | Issues | Action | Opr. | Suspense | Status |
|---|---|---|---|---|---|---|
| 5.02 | Implementation Management: | | | | | |
| 5.02.01 | Has a transition plan between the developer and user been developed and approved? | | | | | |
| 5.02.01.01 | Has an agency/office been designated to manage the implementation process? | | | | | |
| 5.02.01.02 | Has analysis been conducted to determine what operational procedures or other activities will be changed or replaced by the new technology? | | | | | |
| 5.02.01.03 | Will use of the technology free operational equipment that was previously required to conduct certain phases of training? | | | | | |

# Science and Technology Investment Strategy Checklist

| Item# | Item | Issues | Action | Opr. | Suspense | Status |
|---|---|---|---|---|---|---|
| 5.02.01.04 | Have the activities needed to implement the new technology been identified? | | | | | |
| 5.02.01.05 | Has it been determined how items will be supported? (e.g., supportability funds, in-house or contract.) | | | | | |
| 5.02.02 | Will potential users/managers of the technology need to be trained in its use? | | | | | |
| 5.02.03 | Will users and supervisors have time available to learn to use the new technology? | | | | | |
| 5.02.04 | | | | | | |

# Science and Technology Investment Strategy Checklist

| Item# | Item | Issues | Action | Opr. | Suspense | Status |
|---|---|---|---|---|---|---|
| 5.03 | <u>Implementation Resources:</u> | | | | | |
| 5.03.01 | Have funding sources been designated for all aspects of deployment and implementation, including hardware and software purchase (as needed); training of users; local supplies, equipment, and facilities; and maintenance on-site? | | | | | |
| 5.03.02 | Is there a manpower impact (plus or minus) associated with implementation of the technology? | | | | | |
| 5.03.02.01 | Is the manpower impact in user agencies? | | | | | |
| 5.03.02.02 | Is the manpower impact in ATC or other training agency? | | | | | |
| 5.03.03 | Is appropriate staffing available for managing implementation, local use, maintenance, and updating the technology? | | | | | |

# Science and Technology Investment Strategy Checklist

| Item# | Item | Issues | Action | Opr. | Suspense | Status |
|---|---|---|---|---|---|---|
| 5.03.04 | Are needed facilities, equipment, and supplies available and assigned at the unit level? | | | | | |
| 5.03.05 | Has an appropriate time-line been designed for carrying out implementation processes? | | | | | |
| 5.03.06 | Is the production availability of the technology and all supporting equipment congruent with the time-line established? | | | | | |
| 5.03.07 | Is the use of the new technology compatible with existing regulations and procedures? | | | | | |
| 5.03.08 | | | | | | |

# Science and Technology Investment Strategy Checklist

| Item# | Item | Issues | Action | Opr. | Suspense | Status |
|---|---|---|---|---|---|---|
| 6. | ***DOCUMENTATION & FOLLOW-UP*** | | | | | |
| 6.01 | <u>Documentation of Development Process:</u> | | | | | |
| 6.01.01 | Have the decision and development processes for the technology been documented to specify what lessons were learned during development? | | | | | |
| 6.01.02 | Have lines of research that were not productive been documented to prevent needless replication? | | | | | |
| 6.01.03 | | | | | | |

# SCIENCE AND TECHNOLOGY INVESTMENT STRATEGY CHECKLIST

| Item# | Item | Issues | Action | Opr. | Suspense | Status |
|---|---|---|---|---|---|---|
| 6.02 | <u>Documentation for Technology:</u> | | | | | |
| 6.02.01 | Has documentation been written for the new technology? | | | | | |
| 6.02.02 | Is documentation available for different types or levels of users? | | | | | |
| 6.02.03 | Has the documentation been tested for clarity and usability among the intended users? | | | | | |
| 6.02.04 | Is documentation available for maintaining the technology? | | | | | |
| 6.02.05 | | | | | | |

# Science and Technology Investment Strategy Checklist

| Item# | Item | Issues | Action | Opr. | Suspense | Status |
|---|---|---|---|---|---|---|
| 6.03 | <u>Follow-up:</u> | | | | | |
| 6.03.01 | Are there provisions for follow-up data collection to determine whether the technology is operating properly in the field? | | | | | |
| 6.03.02 | Is the technology being used as intended? | | | | | |
| 6.03.03 | Is there evidence of user satisfaction with the product(s)? | | | | | |
| 6.03.04 | Are changes, revisions, or modifications required? | | | | | |
| 6.03 05 | Have procedures been established for production of meaningful progress reports? | | | | | |
| 6.03.06 | | | | | | |

# Appendix J

# Science and Technology Investment Strategy Checklist Reference Document

# SCIENCE & TECHNOLOGY INVESTMENT STRATEGY CHECKLIST REFERENCE DOCUMENT

***Prepared For:*** Technical Training Research Division
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# 1.0 THE PROBLEM

The driving force behind most research in science and technology is generally the effort to solve a problem or take advantage of a research opportunity. Problem-driven research tends to respond to specific needs, such as reduced training time or improved overall performance in a certain specialty. Opportunity-driven research, on the other hand, is generally guided by the possibility of enhancing an activity beyond its current capabilities, or the hope of creating an entirely new activity. Initial research in virtual reality is a prime example of an entirely new activity which takes advantage of breakthroughs in technology to enhance training capabilities far beyond the potential of existing simulators.

Another distinction made between types of research is the division between theoretical and applied research. Both theoretical research (research directed towards adding to the general body of knowledge on a particular topic) and applied research (research directed towards producing immediately useful products or information) can also be either problem or opportunity based. For example, a problem such as accurately determining how children learn to apply the rules of language would be classified as theoretical research, because the results may not have any immediate practical significance. However, in the future, those results may well lead to solutions of important real world problems. Applied research can start from the perspective of addressing a problem or taking advantage of breakthroughs in one area to further existing research in another.

## 1.01 Problem/opportunity identification

### 1.01.01 Has the reason for this investigation been identified and documented?

Without a clear and compelling reason for conducting research, the likelihood of gaining funding and organizational support is significantly reduced. For all research, the formulation of an initial statement presenting the rationale for the investigation, and a clear research question or hypothesis, is critical. A clear presentation is one that states, in the simplest terms possible, what the research is, and why it should be carried out. This statement should include the current condition or problem that can be improved, and the way in which the research will improve that condition (what positive effect the research will have on the current condition). This improvement could be an increase in knowledge or a change in procedure. When appropriate, a statement of the rationale for research should include an explanation of what could happen if the research is not conducted. This could be, perhaps, that the current undesirable situation will continue, become

## EXAMPLES OF RESEARCH RATIONALE

1. A real, identified need exists.

2. A theoretical problem to overcome.

3. The opportunity to significantly improve an approach or outcome, even when no problem or need is currently recognized.

Furthermore, the researcher must make sure that the reason for the research is specific to the needs of the Air Force. When preparing a statement of rationale for research, it is sometimes helpful to use documentation from sources outside of your own organization. This could be information from previous studies, or statements from agencies or commands that would benefit from the research.

## FORMULATING THE RESEARCH QUESTION

Documenting the goals of an investigation is a good way to maintain a strong focus, and to clear up any ambiguity or confusion that may occur later. This document can and should be referred to, periodically, as a tool for evaluating the direction of the project.

The following section provides detailed information on how to identify the reason for your investigation by creating a workable "statement of problem" in the form of a research question or a hypothesis. A clear understanding of the problem that is being studied is the foundation of every solid research project--by defining the problem to everyone's satisfaction, the investigative efforts will be sharply focused and, consequently, more productive.

## STATEMENT OF PROBLEM

In any given research project, the first step should always be the statement of a problem, and the establishment of either a **research question** or a **hypothesis**. As mentioned earlier, the former is more common in applied research (research that is directed towards solving a problem) and the latter is more common in pure research (research directed at adding to the general body of knowledge on a given subject). Since the Air Force tends to be more concerned with applied research issues, we will primarily focus on the formulation of a research question. However, the following section will briefly discuss the process of building and testing a hypothesis--simply because it is one of the basic scientific principles of research methodology.

## BUILDING AND TESTING A HYPOTHESIS

A "hypothesis" is a statement describing a relationship between two or more variables--a short statement of what it is that you are trying to prove. Scientists use them as a way of keeping their research within manageable confines.

Of the two or more variables in the hypothesis, one is the **"dependent variable"** and the others are **"independent variables"**. The dependent variable is the focus of your research effort. As a researcher, your job is to test your hypothesis to see if the relationship you described is indeed true. This is accomplished by systematically testing the independent variables in order to measure and document their impact on the dependent variable.

*Example*

A researcher wants to establish if the use of a specific colored background screen in a CBT (computer based training) presentation will positively affect the retention of the information. So, our researcher develops the following hypothesis:

> *The color of the background screen in a CBT positively affects the rate of information retention.*

In this case, the dependent variable is the rate of information retention--this is what we want to measure--and the independent variables are the different possible colors of the background screen--these are what we will vary to test the nature of the relationship. In a hypothesis based experiment, there can be no ambiguity--your job is to test the hypothesis and ascertain if it is true, or not true. But be careful, in most cases if the hypothesis is not true, you do not necessarily know that the opposite is true.

## FORMULATING A RESEARCH QUESTION

A research question is generally more useful than a hypothesis when dealing with issues in applied research. Building and testing a hypothesis is a good methodology for solving problems that begin with "Does...?" and "Can...?", for example. Research questions, on the other hand, are more effective when dealing with problems such as "Why...?" and "How...?".

Formulating a research question is much easier than building a hypothesis, because they can be much broader in scope.

*Example*

A researcher wants to find out if air pollution affects an airmans ability to fly.

So, our researcher develops the following research question:

*Does air quality affect an airmans ability to fly ?*

OPERATIONALIZING VARIABLES

Now that a research question or a hypothesis has been formulated, the next step is to operationalize all the variables that will be used in the experiment. This assures that there is no ambiguity as to what it is that you are studying.

The process of operationalizing a variable is quite simple, but extremely important. The easiest way of looking at it is that to operationalize variable "X" you simply have to answer the question: what do I mean by "X", in terms of this experiment ? Be exact !

Technically speaking, there are two types of operational variable definitions--"measured" and "experimental". Measured definitions, as the name implies, describe how a variable will be measured during the research. An experimental definition, on the other hand, describes how a concept will be represented as a variable in the research.

## 1.01.02 Have the specific needs of the training environment to be investigated been identified?

Every training environment has characteristics, or a combination of characteristics which are unique. This in turn influences how needs can be addressed within each training environment. The use of computer based training by a highly mobile squadron could necessitate the use of portable computers which would in turn create limitations on the CBT program, such as the use of color graphics displays. Even if a training related effort is intended for Air Force wide distribution it is important to consider how the product will fit in the training environment.

## 1.01.03 Have the specific aspects of the training environment to be investigated been identified?

A research project may impact one or more aspects of training. The training environment is divided into many specific areas, each of which is important to the outcome of training. These areas are:

Management
Development
Delivery
Evaluation

Documentation

Within each area are sub areas. The ISD model is usually an appropriate framework to use to identify the specific sub areas of the training environment.

## 1.01.04 Has a research strategy been developed?

The research strategy should not be confused with research design. The research strategy describes the overall technique and activities that are required to assure that the research is carried out. The factors covered in the Science and Technology checklist can be used to provide a framework of factors than need to be covered in order to carry out a successful research effort.

Some of the important factors to consider in a research strategy are:

o address recognized, real, and substantial needs
o with realistic objectives
o using feasible enabling technologies
o have customer participation and high-level customer support
o in a risk-tolerant research and development environment
o have competent people
o have quality leadership

Without a strategy carefully laid out, the likelihood of carrying out a successful research effort is limited.

## 1.01.04.01 Have research methods, solutions, or options been selected to satisfy the requirements?

Practically any research problem can be addressed using a variety of different research methods. However, the most appropriate research methodology is one that takes advantage of environmental factors such that it would produce the greatest gains for the least expense. A problem that at first glance is a purely an experimental or developmental effort could be enhanced by conducting surveys and interviews if their are indications that the solution to the problem may already exist, in bits and pieces. In such a case gathering existing findings can reduce much of the experimental work needed to produce an application.

At other times survey research may appear to be the best approach. The research should first determine if the information can be gathered from existing documentation. The basic idea is "not to re-invent the wheel."

## 1.01.04.02 Have assumptions been developed, documented, and coordinated?

For practically any research effort, the researcher must of necessity make certain assumptions. These assumptions may deal with such issues as the availability of or access to information and personnel, the cooperation of outside organizations, the available facilities, and "no cost" support for certain activities, such as scheduling research participants or survey respondents.

The researcher should not leave these assumptions as assumptions, but actively strive to determine if what is assumed is, in fact, correct. If support, for example, is expected from a MAJCOM, contact the MAJCOM and assure that the support will be forthcoming. At times the researcher may find that support promised was only valid within a very specific time frame. To avoid problems resulting from unsupported assumptions the researcher should carry out the following activities.

a. List all assumptions or expectations that are felt necessary in order for the project to be successful.

b. Check to determine if such assumptions are correct and document the findings.

c. If a critical assumption does not prove to be correct determine if the assumption was absolutely essential or that the problem that arises can be addressed in other ways. It may prove necessary to reconsider the feasibility of the research.

## 1.01.04.03 Have problems in the research approach been identified?

Identifying potential problems in a research activity and planning to deal with them can often eliminate or lesson the effect of the problem on the research. There are two classes of problems related to any research approach:

a. **Problems inherent to the particular research approach.** Every research approach, whether it be experimental, survey, archival, or any method or combinations of methods, will have inherent flaws. Numerous volumes have been written on the subject and most researchers have taken course work that at least in part address inherent weaknesses in a research approach.

b. **Problems unique to the application of a research approach in a specific environment.** In some cases a research approach may have proven very successful in one environment and a clear failure in only a

slightly different environment. The researcher must ask what would cause a specific approach not to succeed.

### 1.01.05 Has the research identified specific areas or problems where application of technology may be appropriate?

The application of technology to a problem can often prove to be the most cost-effective and useful method of addressing an issue. Yet at other times it may in fact be totally non-productive. Care must be taken to realistically appraise the current situation that is being analyzed to make a cost-benefit based decision as to the relevancy and utility of a technologically based solution.

### 1.01.06 Has a plan of action been developed?

A plan of action is a written description on how to carry out the proposed research. The plan of action should not only list what has to be done, but also how it is to be done, and in what order the activities will be performed. A detailed plan of action, regardless of its format, needs to be as specific as possible. The plan of action should be a map of all the activities that need to be performed to get from Problem to Solution.

The plan of action may have to be re-visited and modified during the life of a research project. Often the solution to a problem is not absolutely clear but as the research progresses it becomes more focused.

### 1.01.07 Will the findings of the plan of action lead to technology required?

If the desired solution is technology based, it is important that the plan lead to a technological solution, IF FEASIBLE. Any researcher must be willing to accept the possibility that the initial concept, and the assumption that technology is the appropriate solution may not be correct. For some research activities the need for technology is obvious and documented. In such cases the researcher should consider whether the technology being considered is appropriate. Technologies that can address a problem -- even related technologies -- can differ enough to cause significant differences in outcomes. An expert system job aid built around an AI language such as ProLog would take less time to develop cost less, and be more reliable than if the research effort required that all programming be done in ADA where the basic shell would have to be created from scratch.

## 1.02 Characteristics of the Products(s) to be Produced:

### 1.02.01 Have the physical characteristics of the product(s) to be produced been identified?

Whatever is produced must fit in the environment in which it will be used. Even a printed document must be structured appropriately for use. The approximate format and language must fit the user. A document intended for use by research may have little resemblance in the language and structure of the report from one intended for decision makers.

For any physical product, the physical characteristics can be significant. If the product is hardware, or partly hardware, its size and weight may be an important consideration.

### 1.02.02 Have the functional characteristics of the product(s) to be produced been identified?

The functional characteristics of a product should be based on its intended use and the characteristics of the intended users. Ignoring either factor can result in a poor product. If the product is software, the programming style (for example, block programming for ease of modification) and user interface screen design are important characteristics.

## 1.03 Externally Generated Priorities:

### 1.03.01 Have priorities for research been established by "external" activities (e.g. Air Staff, MAJCOM, user)?

The researcher must consider the potential user's needs. Without a "customer" the likelihood of a research product actually becoming operational is reduced significantly. External support strengthens the visibility and viability of a research effort. An external potential user or party interested in the outcomes of a research effort should be directly involved in setting goals for the research activity. This does not mean that an external party needs to be involved in every phase of the research design and execution only that their needs be considered. It would make little sense to develop the most advanced training tool in the world if it was so manpower and capital intensive as to eliminate even the consideration of the tool being used. At least some potential customers should be involved, and their concerns should be addressed.

### 1.03.01.01 Have the above priorities been accommodated by the research plan and approach?

This is a Yes / No question.

### 1.03.01.02 If the above priorities have not been accommodated, has this been discussed with the official who established the priorities?

This is a Yes / No question.

### 1.03.01.03 Does that official agree with your "re-prioritization?"

If the answer is NO the researcher should be looking for other customers, or trying to change the mind of those who disagree with the re-prioritization.

### 1.03.02 At least annually, have you checked with these external activities to reconfirm their priorities?

If possible, a formal briefing would be the best method to assure continued support, especially when a significant staff or leadership change occurs. Priorities change over time and between individuals. Changing conditions could have reduced the importance, and funding, or your specific research. Involving the customer in setting priorities, and then checking with them to reconfirm priorities is absolutely essential. Not involving the customer is a critical shortcoming and should be addressed.

### 1.04 Internally Generated Priorities:

### 1.04.01 Is there clear rational for internally generated priorities?

In most cases research efforts are not carried out by a laboratory to satisfy a "customer's" needs. A research effort may supplement other ongoing research or provide information needed for additional research. The research organizati may, and most likely does have, its own research agenda, and a specific research activity may have been developed primarily because it advances that research agenda.

### 1.04.02 Are the internally generated priorities compatible with the externally generated priorities?

Yes / No. If no this issue must be faced and a solution developed.

## 1.04.03 Is there external oversight for internally generated priorities?

A research project can often benefit from the presence of external oversight for some of its internal activities. The presence of another perspective can often point broaden the scope of options available to the research team.

If there is external oversight, a procedure for consultation and appraisal should be set in place at the outset of the project to ensure that there is a sense of cooperative effort in the project, rather than an occasional intrusive presence.

### 1.04.04 Can (will) your agency commit to the project and its expected time-line?

This particular question may well be revisited time, after time, by a researcher till the agency commits to a project. Since the competition within a research laboratory for limited funding is high, worthwhile efforts are often rejected. Decision makers have to make the decisions on various grounds. If, for example, a highly worthwhile research proposal is submitted, but its funding requirements are such that several other equally important projects would have to be dropped, decision makers may have little choice and not fund the more expensive effort.

If a project is rejected the researcher should find out why. With information, it may be possible that, in the next funding cycle, a stronger case can be made, or the project can be restructured so as to have a better fit with the overall research agenda, or with the funding available.

# 2. THE TECHNOLOGIES

## 2.01 Identification of Technologies:

"Technology" can be defined as the process of applying scientific knowledge to any activity or operation in order to increase its efficiency. Using technology in problem-solving requires a systematic approach, and must take into consideration many factors.

Technology is often mistakenly defined only in terms of the hardware associated with the technological revolution: computers, missiles and other "physical" objects. However, in truth, technology encompasses not only such hardware, but ideas and concepts as well.

In a broad sense, technology can be considered as having two main components:

(1) a hardware aspect, consisting of the tool that physically embodies the technology.

(2) a software aspect, consisting of the information base for the tool.

Although the interdependence between a tool and the way in which it is used, is critical to accomplishing a task, the tool is easier to identify with. It is because of this, that people often think of technology mainly in terms of hardware. Understanding this interaction or interdependence is the key to the successful use of technology.

In a general sense, in many cases the hardware side of a technology is dominant, mostly in cases where the user is not a significant part of the process. But in other cases, a technology may be almost entirely comprised of information, ideas and concepts.

### 2.01.01 Have the characteristics of the needed technologies been identified?

An analyst should take a proactive approach to identifying the characteristics of a technology before making any attempt to select a technology to fulfill a need. A "proactive approach" involves *defining the characteristics* of the needed technologies. By carefully defining the needed characteristics, the analyst can avoid the two greatest pitfalls of new technology implementation: (1) investing so much that system capabilities are neither utilized nor cost-efficient, or, (2) investing so little that the system becomes an obstacle rather than an enhancement to

productivity. The problem of finding the correct *balance* for specific requirements can be difficult to surmount. Finding the right balance before any investments are made is a critical part of this process.

The first step taken by the analyst to perform this evaluation should be to formally identify the need for a new technology and to describe its characteristics. This could include, for example:

- Determining the desirability and practicality of automating a manual system,
- Looking for ways to make existing processing capabilities more efficient and responsive, or
- Attempting to enhance an existing automated system by adding processing capabilities to meet new requirements.

The identification of the characteristics of the needed technology can be accomplished by the following key activities:

- Identify and define assumptions.

  Assumptions are simply statements of the organizational and managerial priorities, and the technical and operational considerations which define the context of the proposed project.

One of the first objectives is to identify and define *the assumptions* that affect the scope and validity of the need.

- Establish evaluation criteria.

  In any type of analysis, solid evaluation criteria are necessary in order to properly select a solution which truly meets the needs of the organization. This criteria will be useful in evaluating alternative solutions which may be, or may already have been proposed in the attempt to meet the expressed need.

  While most often this criteria will be used to "maximize net benefits" (e.g., to identify the solution whose measurable benefits most exceed its measurable

costs), other criteria which can be considered maybe useful in minimizing costs or for obtaining the best cost/benefit ratio.

- Identify and define alternative solutions.

  It is recommended that at least two distinct alternative solutions be generated. In some situations, this may be accomplished by simply varying such characteristics as timeliness, flexibility or security.

- Identify cost/benefits.

  This activity has three parts, as follows:

  (1) Identify costs.

  All expected areas should be determined where costs may be incurred. Areas of possible costs that should be reviewed are procurement, start-up, project related, operating, security, etc.

  (2) Identify benefits.

  All types of benefits that are expected to accrue should be determined. Potential benefits include reduction in per unit costs, improved accuracy, increased speed of operation, etc.

  (3) Adjust for present value.

  After identifying the specific cost and benefits for each alternative solution for the need, cost figures should be adjusted for their present value.

- Analyze results.

  If two or more alternatives solutions appear feasible and have similar total net benefits, the critical assumptions that affected the results should be re-examined.

- Develop project development plan.

  The project development plan is evolutionary. Plans and schedules are continually adjusted as analyses result in more definitive assessments and

projections. Milestones are scheduled and major tasks are reduced to smaller, more discrete tasks.

## 2.01.02 Was a market survey performed to identify viable commercial products that best satisfy this requirement?

To discover whether or not a market survey was performed to identify commercial products that might exist to satisfy this requirement, the analyst should be aware of the following:

- Problem definition

A concise statement of the topic in question is very important. Without a precise definition of the topic, the analyst may collect irrelevant and expensive information and confuse rather than clarify issues. A good definition of the problem directs the analyst toward the collection and analysis of specific information to satisfy his/her requirement.

- Sources

Market survey information is available from both government and non-government sources. Three major sources of commercial or non-government information are:

(1) Regularly published periodicals contain articles on various aspects of marketing surveys and are available in most libraries. Some are quite broad in scope (Business Week, Journal of Marketing); others are more specialized (Journal of Advertising, Journal of Consumer Research). These periodicals are published by professional associations, regular publishing companies or trade associations. The orientation of these periodicals varies widely. Selected examples are:

| | |
|---|---|
| Advertising Age, weekly | Journal of Business, quarterly |
| Business Horizons, bimonthly | Journal of Consumer Research, quarterly |
| Business Week, weekly | Journal of Marketing, quarterly |
| California Management Review, quarterly | Journal of Retailing, quarterly |

Chain Store Age, monthly

Columbia Journal of World Business, quarterly

Editor & Publisher's Market Guide, annual

Fortune, semimonthly

Graphic Guide to Consumer Markets, annual

Harvard Business Review, bimonthly

Journal of the Academy of Marketing Science, quarterly

Journal of Advertising, bimonthly

Journal of Advertising Research, quarterly

Journal of Small Business Management, quarterly

MSU Business Topics, quarterly

Nielsen Researcher, bimonthly

Progressive Grocer, monthly

Rand McNally Commercial Atlas & Marketing Guide, annual

Sales & Marketing Management, monthly

Stores, monthly

University of Michigan Business Review, quarterly

Books, monographs, and other nonrecurring literature are published by a number of organizations. Some groups, such as the American Marketing Association, disseminate information to increase knowledge and professionalism. Others, such as the Better Business Bureau, are involved in self-regulation and public opinion. Yet another type, such as the National Retail Merchants Association, functions as a spokes person for an industry as well as an information disseminator. Each of these organizations distributes materials for a nominal fee or free of charge. The following publish a wide variety of information pertaining to marketing:

American Management Association Banks
American Marketing Association Foundations
Better Business Bureau Research institutes
Chamber of Commerce Trade associations
Other Universities

Commercial research houses conduct periodic and ongoing studies and make the results of the studies available to many clients for a fee. The fee can be quite low or range into the tens of thousands of dollars, depending upon the extent of the information. The following commercial research houses sell information to subscribers:

| | |
|---|---|
| A.C. Nielsen | National Family Opinion |
| Arbitron | National Purchase Diary Panel |
| Audit Bureau of Circulation | R.L. Polk (mailing lists, automobile data) |
| Audits and Surveys | Selling Area-Marketing, Inc. (SAMI) |
| Dun and Bradstreet | Standard Rate and Data Service |
| Market Research Corporation of America | |

- Advantages

This type of information is inexpensive, easy to assemble, and provides background data about the problem. There frequently are several sources of secondary data. These allow the analyst to obtain various perspectives, to gather large amounts of information and to verify data. When information is assembled by an independent source such as Fortune or Business Week, the results are believable. Both of these sources have a high level of credibility and a reputation for thoroughness.

- Disadvantages

Available information may not suit the purposes of current research because it was collected for other reasons. For example, the units of measure may be different from what are needed. The information may be dated or obsolete. It may have outlived its usefulness. The precision with which the information was collected may be lacking. The purpose, data collection technique, and method of analysis of the original study should each be examined for bias. Lastly, the reliability of the information is not always known. Many research projects are not re-tested.

## 2.01.03 Has a literature search been conducted to determine what technological capabilities are available from industry?

Although military R & D is often at the forefront of cutting edge research, there may be parallel developments taking place in the private sector. In order to save costs and avoid replication, conducting a literature search to determine what technological capabilities are available from industry is almost always a good idea. If

the literature search does not yield a solution, it will at least provide guidelines to determine the direction of the existing research.

There are many resources and tools available to conduct literature searches. The most widely used are a variety of on-line data bases such as the selected listing provided below:

ABI/INFORM (Abstracted Business Information)
1971 to present, updated monthly

Covers 550 international business management publications in such fields as economics, accounting, marketing, management science, insurance and real estate.

AIM/ARM (Vocational and Technical Education)

A specialized index of information about vocational and technical education and related areas. It covers materials published between 1967 and 1976. More recent publications have been incorporated into the Educational Resources Information Center (ERIC).

BOOKS INFO

Contains citations of books currently in print. Provides information about the author, publisher, price, subject descriptors, LC card number, and ISBN number.

COMPREHENSIVE DISSERTATION INDEX
1861 to present, updated monthly

Includes most dissertations in the United States and a selected listing from foreign universities. Citations are provided so that abstracts may be found in the published Comprehensive Dissertation Index volumes. Complete copies of the dissertations may be obtained from University Microfilms, Ann Arbor, Michigan.

Congressional Information Service
1970 to present, updated monthly

A guide to the publications of the United States Congress that cover hearings, committee reports, and special committee and subcommittee publications.

ERIC (Educational Resources Information Center)

1966 to present, updated monthly

Contains indexes of over 700 periodicals and several hundred thousands of research reports, projects, and monographs in education.

THE INFORMATION BANK
1974 to present, updated monthly

Compiled by the New York Times and other major newspapers, and provides abstracts of articles on current events from over 60 newspapers, magazines, scientific and financial periodicals.

INFORMATION INDUSTRY MARKETPLACE 1981: An International Directory of Information Products and Services

A comprehensive guide to companies and organizations providing computer products, supplies and services. The publication lists data base publishers, machine readable data bases, printed products derived from data bases, and support services and suppliers.

INSPEC (Physics, Electronics, Computers)
1969 to present, updated monthly

Includes physics, electrical and electronic, and computer and control abstracts.

NATIONAL NEWSPAPER INDEX
1979 to present, updated monthly

Includes the Christian Science Monitor, New York Times, Wall Street Journal, Los Angeles Times and the Washington Post.

PTS

A guide to the U.S. and international manufacturing, marketing and industrial forecasts.

SCISEARCH
1972 to present, updated semi-monthly

A multi disciplinary index which provides access to 90 per cent of the world's significant scientific and technical literature. It contains references from both the Science Citation Index and the Current Contents.

SOCIAL SCISEARCH

1963 to present, updated monthly

Contains an index of 1000 social science journals and social science articles from over 2200 other journals.

SOCIOLOGICAL ABSTRACTS
1963 to present, updated quarterly

Contains an index of world literature on sociology and related disciplines. It includes selected articles from over 1200 journals.

SSIE (Smithsonian Science Information Exchange)

Contains reports of government and privately funded science and social science research projects, either in progress or initiated and completed, during the past two years. It provides the name of the project investigator, funding agency, summary and detailed subject descriptors.

There are also a wide variety of published directories and guides to secondary sources of research information. A listing of selected sources is provided below:

Applied Science and Technology Index

A subject index to over 200 journals in aeronautics, space science, energy engineering, fire prevention, chemistry, computer technology, food and food industries, geology, machinery, mathematics, mineralogy, metallurgy, oceanography, petroleum and gas, physics, textiles and fabrics, and transportation.

Communication Abstracts

A quarterly index of major articles, books, and monographs related to communication. It contains abstracts of indexed publications.

The Directory of Directories

An annual compilation of directories. It is a "road map" to guides indexed by subject matter and title.

Dissertation Abstracts International

A publication including titles, key words and author indices for doctoral dissertations in over 350 institutions in the United States and abroad. It

provides dissertation abstracts and is published monthly. Complete copies of dissertations can be ordered from University Microfilms of Ann Arbor, Michigan.

Engineering Index

A monthly guide to engineering literature.

Human Resources Abstracts
(formerly Poverty and Human Resources)

An abstract journal of Sage Publications providing coverage of human resource and social problems ranging from slum rehabilitation and job development training to compensatory education, minority group problems and rural poverty.

INFORM

Contains abstracts of articles in over 400 English-language management and administrative science journals.

New York Times Index

A guide to the contents of the New York Times and includes *brief summaries* of articles.

Readers Guide to Periodical Literature

A directory containing subject and author indexes of more than 150 general publications in the United States. It has been published semi-monthly since 1900.

Science Citation Index

Comparable to the SSCI (see below) but for the natural sciences. It includes approximately 90 per cent of the significant scientific and technical literature published worldwide.

Social Science Citation Index (SSCI)

Indexes the significant items from approximately 1000 worldwide social and behavioral science journals in the natural, physical, and biomedical sciences. It includes citation index, author index (first author only), and subject index. It has been published by the Institute for Scientific Information since 1969.

Social Science Index

A subject and author index to articles in more than 260 journals in the social and behavioral sciences, law, medicine, and related subjects.

Sociological Abstracts

Provides abstracts of selected articles from over 1200 articles in sociology and related disciplines.

Trade and Industry Index

An index that provides complete listing and selective abstracts of 275 trade and industry journals and selective indexing of 1200 additional publications.

Wall Street Journal Index

A guide to the contents of the Wall Street Journal. It contains two separate published sections covering general news and corporate news.

Work Related Abstracts

An annotated index of books, articles, and dissertations covering labor relations, personnel management, and organizational behavior.

(This list of on-line data bases and secondary research guides was compiled from Secondary Research, D.W. Stewart, Sage Publications, 1984).

## 2.01.04 Can existing technology be modified or adapted to satisfy this requirement?

Before embarking upon the development or acquisition of a new technology to satisfy a determined need, it is a worthwhile exercise to investigate existing technology to determine if it can be modified or adapted in some way to satisfy the requirement.

One technique that may be used to investigate this possibility is to analyze the ways in which the workers are currently using the existing technology to meet this new requirement. Despite the stringent development and implementation guidelines of researchers, the average worker will often find a way to "re-invent" existing technologies to solve the new problem. Therefore, by analyzing the ways in which the workers are using existing technology in a manner other than intended, the

analyst can often gain valuable insights into how an existing technology can be formally modified or adapted to fit a new requirement.

In addition, the compatibility of a new technology, or idea, with existing technology can either accelerate or retard the rate of adoption. It is often hard for end-users to deal with a new technology except on the basis of the familiar and old fashioned. Previous practice is a familiar standard against which the new technology can, and most likely will, be interpreted, as users assess the new tool, system or method. So, the analyst must strongly consider that the rate of adoption of new technology is affected by the existing idea that it supersedes.

It is obvious that if new technology were completely congruent with existing practice, there would be no need for innovation. In other words, the more compatible new technology is with the old way of doing something, the less of a change it represents. So what is the use, then, of the introduction of a very highly compatible technology? The introduction of a compatible technology is useful as *a first step in a series of innovations that are to be introduced sequentially*. The compatible technology paves the way for later, less compatible innovations.

## 2.01.04.01 Was a market survey performed to identify viable government-owned products that best satisfy this requirement?

To discover whether or not a market survey was performed to identify viable government-owned products that might exist to satisfy this requirement, use the concepts discussed above for the commercial sector. They hold true for the government as well.

In searching for this information it is important to note that the government itself is usually the best source for information about its activities. The government routinely collects and distributes a wide range of statistics and descriptive materials. Government agencies publish many pamphlets on topics such as franchising, pricing, credit, product warranties, and deceptive sales practices. These materials are usually distributed free of charge, or sold for a nominal fee. The Monthly Catalog of United States Government Publications contains a listing of these items.

- Sources - Market survey information of government-owned products is available from two major sources:

  Selected publications are:

  American Statistical Index (Congressional Information Service), annual with monthly updates

Annual Survey of Manufacturers (Department of Commerce), annual

Business Statistics (Office of Business Economics), biennial

Catalog of U.S. Census Publications (Bureau of Census), quarterly

Census of Manufacturers (Bureau of Census), every five years ending in 2 and 7

Census of Population (Bureau of Census), every ten years ending in 0

Census of Retail Trade, Wholesale Trade, and Selected Service Industries (Bureau of Census), every five years ending in 2 and 7

Census of Transportation (Bureau of Census), every five years ending in 2 and 7

County and City Data Book (Department of Commerce), several times each decade

Federal Reserve Bulletin (Federal Reserve System), monthly

Monthly Labor Review (Bureau of Labor Statistics), monthly

Monthly Urban Review (Bureau of Labor Statistics), monthly

Statistical Abstract of the United States (Department of Commerce), annual

Survey of Current Business (Office of Business Economics), monthly

Vital Statistics Report (Health, Education, and Welfare), monthly

Government agencies of interest:

Bureau of Census
Bureau of Labor Statistics
Congressional Information Service

National Center for Educational Statistics
National Center for Health Statistics

Consumer Product Safety Commission
Department of Commerce
Department of Labor
Environmental Protection Agency
Federal Reserve System
Federal Trade Commission
Food and Drug Administration
National Technical Information Service
Office of Business Economics
Small Business Administration
Statistical Reporting Service, Department of Agriculture
United States Postal System

## 2.01.04.02 Has the investigation of currently available technology produced results?

If the answer to this question is yes, the analyst must determine whether it is possible to modify the available technology to fulfill the purpose of his/her project. This determination should be made inconsideration of such issues as survivability in combat, lifespan of equipment, compatibility with existing equipment, cost effectiveness, etc.

## 2.01.05 Has a literature search been conducted to determine what technological capabilities are forecasted by industry?

Even if the required technology is outside the scope of current private sector research, it is worthwhile to monitor the trends of any related industries. This will serve two purposes. First, it will prevent investment in an area in which a major research has already taken place, and positive results are soon expected. Secondly, it will ensure that any new technology that is developed can be designed in such a way that it can conform to any newly created or developing standards.

Equipment designed to be flexible and easily modified to satisfy new requirements has a higher return on investment than equipment that cannot adapt to new circumstances.

(See paragraph 2.01.03 for a selected listing of on-line information data bases that may aid in this investigation.)

## 2.01.06 Has the investigation of technology in development produced promising results?

Technological innovation implies the introduction of something new -- a new idea, method, or device. The analyst must be able to recognize whether or not something

truly new and creative has been developed, or if promising results have been produced, through the investigation of current technological development. To address this issue the analyst must understand the role technological innovation plays in the research process.

## 2.01.07 Are new technologies required to address the requirement?

At this stage, the analyst must decide if new technologies are required to address the requirements. If the answer is yes, then the decision must be made as to what type of research is required. To answer this next question, the analyst must appreciate the difference between basic and applied research. These two alternatives represent fundamentally different approaches to the creation of knowledge.

Basic and applied research differ in their approach to theory. The goal of basic research is to describe the world in a truthful and accurate manner. Developing and advancing theory is thus the primary focus of science. Opposingly, the goal of applied research is to be useful. As such, theory is only used to guide action, and is only important as a tool to aid in the effort to provide practical solutions to problems.

This basic difference between the search for truth and the search for solutions leads to differences in the types of questions that are asked, the standards of evidence to which one adheres, and the ways in which the final results are communicated. The analyst or researcher who seeks truth, asks questions of interest to him or herself, and seeks to gather the most precise data possible. This is often done in an attempt to support or refute a previously established hypothesis. The results of this exercise are then reported at scientific meetings and in scientific journals, and rarely picked up by the popular press. (These findings may also be further developed and implemented by applied researchers working to solve a problem in that area of study.)

On the other hand, the analyst or researcher who operates within the field of applied research will focus on problems of current concern and focus on those variables that are most easy to manipulate (rather than the most explanatory). The precision of the data that is used is weighed against more practical considerations, such as the cost involved in obtaining it. The applied researcher seeks to confirm that a solution is useful in a given situation or application. Results may be proprietary, if a particular product or process is being studied, or may be widely disseminated.

## 2.01.08 Is basic research required?

If basic research is required, the analyst must have an understanding of the steps involved in conducting basic research. Basic research is defined generally as an original investigation for the advancement of scientific knowledge, that does not have the specific objective of applying this knowledge to practical problems.

In contrast, applied research consists of scientific investigations intended to solve practical problems. Scientific knowledge is put into practice in order to design a technology that will solve a perceived need or problem. Applied researchers are the main users of basic research. Thus, a new technology may result from a sequence of (1) basic research followed by (2) applied research leading to (3) development.

## 2.02 Opportunity Costs:

The analyst must realize that the essence of economic analysis is a systematic common sense approach to the problem of the efficient allocation of resources. It is a formal decision-making process that is consistent with three sound economic principles:

- All reasonable alternative methods of satisfying a given program objective must be investigated.
- Each alternative must be considered in terms of its full life cycle funding and benefits implications.
- Money has value over time as expressed by the price it commands. In other words, this fact is included in an analysis by expressing life cycle costs and benefits *in terms of their present values.*

The economic analysis process is a systematic, interactive procedure for evaluating and ranking alternatives which meet an objective. The proper performance of the process requires the completion of each of the following six steps:

- Define the objective
- Generate alternatives
- Formulate assumptions
- Determine costs and benefits
- Compare costs and benefits and rank alternatives

- Perform sensitivity analysis

## 2.02.01 Are there other possibly relevant technologies that are not being considered or developed?

Even though an exhaustive investigation of all possible avenues of research should by now have been conducted, it is useful to pause for a moment and consider whether there may be other possibly relevant technologies that are not being developed. To accomplish this, one might use the following protocol. Once again, begin by formulating an unbiased statement of the objective. The next step is to determine *all feasible alternative methods of meeting that objective* -- since the ultimate purpose of the analytical process is to assist the decision maker in making the correct decision, it is essential that all realistic alternatives be considered. Making a good decision is extremely difficult (if not impossible) without a full understanding of all relevant options.

Occasionally there will exist certain presumptions concerning the desirability of one or more of the options. There may be, perhaps, some administrative constraints (such as an upper limit on spending) which tend to exclude certain alternatives. Such conditions should in no way decrease the necessity for the analyst to do a complete job. All reasonable and viable alternatives must be considered; otherwise, the value of the analysis is seriously undermined.

## 2.02.02 Is there a cost associated with delaying this research?

The analyst must investigate each alternative to determine all the costs occurring during the entire project life cycle. Therefore, s/he must explore and address any costs associated with delaying this research, and make the appropriate recommendations.

## 2.02.03 Can the benefits expected from this project be quantified?

The essential aspects of an economic analysis are the identification of all the relevant inputs and outputs and the quantification of these costs and benefits to facilitate evaluation. Any economic analysis will involve considerations of both the costs and returns expected for each alternative. In general, there are four types of benefits:

- <u>Direct Cost Savings</u>: Occurs when there is a reduction of direct expenditures; i.e., the budget can be reduced.

- Efficiency/Productivity Increases: Occurs when there is an increase in productivity that can be measured in dollars but does not result in a reduction of the budget.

- Other Quantifiable Outputs: Occurs when there is an increase in productivity or output that cannot be measured in dollars.

- Non-Quantifiable Outputs: These are the intangibles that are measured in non-economic terms like goodness, safety, or morale.

As mentioned in the above item, sometimes benefits cannot be quantified in dollar values. Certain projects may provide non-quantifiable benefits such as increased retention rates, improved morale, better troop habitability, and other similar qualitative advantages. Although these are difficult to measure, these benefits can be documented and assessed in the economic analysis through the use of written qualitative benefit descriptions (for example, as portrayed in an opinion or attitude survey). This is the least preferred method of analyzing benefits due to its inherent lack of precision. However, under certain conditions this method must suffice, and if the following guidelines are observed, qualitative statements can make a positive contribution:

- Identify all benefits attendant to each alternative under consideration. Give complete details.

- Identify benefits common in kind but not in extent or degree among alternatives. Explain differences in detail.

- Avoid platitudes, such as, "all prospective projects are worthwhile in that they support national defense".

## 2.02.03.01 Can the benefits be expressed in terms of reduced life-cycle costs?

One of the benefits that an analyst must address is reduced life-cycle costs. Generally, benefits reflect an expected return on investment (outputs, products or yields). The benefits of each alternative should be expressed in such a way that the decision maker is able to compare various alternatives.

This can be done by calculating the benefit/cost ratio (BCR). The BCR is defined as: benefits divided by costs, for each alternative:

$$BCR = Benefits \div Costs$$

The BCR can be used to express the reduced life-cycle costs of any alternative.

### 2.02.03.02 Can the benefits be expressed in terms of reduced manhours/manpower?

In order for the analyst to determine if the benefits to be gained from his new technology can be expressed in terms of reduced manhours/manpower, he must first gain an understanding of how manhours/ manpower for the civilian and military work force are computed. The next step is to compare the outcome of the new technology manpower requirements to a standard baseline as determined by the government.

### 2.02.03.03 Can the benefits be expressed in terms of increased productivity?

Projects for modernization, rehabilitation, consolidation, and other related goals can often generate an increase in the efficiency of operations or productivity. Such increases are extremely beneficial and should be included in a benefit/cost analysis when they exist. However, it is important to note that benefits of this type are frequently confused with direct cost savings because they are easily quantified in dollar terms. But in reality, they are not equivalent, and the analyst should understand the fundamental difference clearly.

An increase in efficiency or productivity implies only one thing -- the ability to do more work within the existing manpower/funding level. The only way to translate an efficiency/productivity increase into direct cost savings is to effect a reduction in force (RIF) which lowers the required funding level. However, a RIF is not usually intended as the mandated result of a government project, and thus some other means of quantifying efficiency/productivity benefits must be used.

The solution to the problem is really a simple matter of semantics. An efficiency/productivity increase which translates into a labor time savings of two man-years is a benefit. Its value may be defined as: what it would cost the government to buy an additional two man years of labor. This cost should also reflect the appropriate rate for leave and fringes, because the value of benefits should reflect the actual total cost to the government of providing two man-years of work.

One very important caveat must be mentioned at this point. In order to claim an efficiency/productivity increase as a valid benefit, there must be a documented need for the increased workload capacity. In other words, there must be an alternative use

to which the "new" manpower resources can be put, such as reducing a backlog of maintenance. Lacking this, there is no benefit – or at least no quantifiable benefit – derived from the project. Documentation of this fact must be complete and explicit in the benefit/cost analysis.

### 2.02.03.04 Can the benefits be expressed in terms of reduced training costs?

In an environment of downsizing and severely constrained budgets, users will be very receptive to technology which can demonstrate measurable training cost benefits. Therefore, it is important that considerable effort be expended in demonstrating this important benefit. Before answering this question, the analyst needs to establish his/her baseline, that is, what are the current costs of training using the processes/equipment/methodologies to be replaced? If these costs are not readily available, HQ ATC should be consulted for assistance. Considerable cost data reside there. It is important to understand what specific costs are included in these data in order to ensure that equivalent cost categories are used for comparison purposes. Cost categories might include such things as personnel (trainer, trainee, staff and/or other administrative overhead), facilities, equipment, supplies, books, travel, per diem, etc. In estimating the training costs of the training alternatives being pursued, manufacturers/suppliers should be good sources of information, so the analyst should be sensitive to the availability of such information during conduct of the market survey. Also, seek out activities using the same or comparable technology.

### 2.02.03.05 Can the benefits be expressed in terms of reduced training time?

This is significant to the user because, assuming the training is at least as effective as that currently being provided, reduced training time can be directly translated into increased opportunity to be productive on the job. In computing this benefit, the same process/procedures as discussed above in 2.02.03.04 should be used, and, in fact, reduced training time should contribute to reduced training costs.

### 2.02.03.06 Can the benefits be expressed in terms of increased student achievement/performance?

Unless a source can be found, such as an activity experienced in use of comparable technology, this question may be difficult to answer with precision until some testing has been performed. Preceding this, however, a baseline can be established, again using HQ ATC as a logical source if data are not otherwise readily available. And of course the real answer will come when the user is requested to provide feedback after a set period of deployment and operation of the technology.

## 2.02.04 Have life-cycle cost estimates been prepared for the technology under consideration?

The analyst must presume that for all requirements there are alternative choices or trade-offs for reaching the objective, even if one of the options is to maintain a status quo, or to do nothing. Thus, the economic analysis that must be done should incorporate the full life cycle implications of each alternative, in terms of costs and benefits. This is accomplished by:

- Focusing thinking -- both formal and informal
- Surfacing assumptions -- both hidden and presumed -- and identifying their logical implications
- Analyzing all costs, benefits and their timing
- Providing an effective communications vehicle for all considerations in support of the decision.

Life-cycle cost estimates must include all costs in the appropriations accounts of Research, Development, Test, and Evaluation (RDT&E); Procurement; Military Construction (MILCON) (if applicable); Operations and Maintenance (O&M); and Military Personnel for the expected life of the system.

## 2.02.05 Has the expected amortization period for the costs associated with the research been determined?

Amortization is defined as the gradual reduction of the balance in an account according to a specified schedule of time and amounts. It is usually the provision for extinguishing a debt, including interest, by means of a sinking fund or other form of payment.

## 2.02.06 Has expected return-on-investment been calculated?

The first step that the analyst must take in comparing a proposed alternative against the status quo is to calculate the savings to investment ratio (SIR). It is the amount of savings generated by each dollar of investment. Since all government economic analyses must take the time value of money into account, the SIR is mathematically defined as:

SIR = NPV (Savings) ÷ NPV (Investment)

where NPV (Savings) means the present value of the reduced amount of annual expenditures from replacement of the status quo by the proposed investment and NPV (Investment) means the present value of the initial investment for the proposed alternative less the present value of any terminal value.

The savings to investment ratio (SIR) should be greater than one (1) in order for the proposed project to be considered cost effective. In other words, the proposed alternative should generate more savings that it costs to implement.

### 2.02.07 Does the technology provide a detectable and meaningful improvement over existing capabilities?

Once the analyst has determined the costs and benefits of all the alternative solutions, he must decide which alternative to recommend to the decision maker. To do this, the analyst must compare costs and benefits and rank the alternatives.

In general, there are four possible outcomes when comparing two or more alternatives:

- EQUAL COSTS/EQUAL BENEFITS
- EQUAL COSTS/UNEQUAL BENEFITS
- UNEQUAL COSTS/EQUAL BENEFITS
- UNEQUAL COSTS/UNEQUAL BENEFITS

Using this method, the analyst can determine if the new technology provides detectable and meaningful improvement over existing capabilities.

## 2.03 Trade-off Studies:

Trade-off analysis is defined as a means to examine alternate ways of meeting the requirements that were identified.

### 2.03.01 Has the cost of doing nothing been assessed?

After the objective of the analysis has been established, the next step is to determine

all feasible alternatives or ways of meeting the objective. In other words, all the alternative means by which the objective can be reached must be identified. It is important for the analyst to note that the status quo, or the cost of doing nothing, is often a viable alternative and must be assessed.

### 2.03.02 If alternatives are feasible, have their costs been calculated?

See 2.02.04 above and calculate life-cycle costs for each alternative being considered.

### 2.03.03 If alternatives are feasible, has their effectiveness been determined or estimated?

Although there may be other ways of measuring effectiveness of the technology, it is essential that the levels of proficiency anticipated to be attained by the trainees be assessed/estimated for each alternative. As indicated in 2.02.03.06 above, precision cannot be expected at this point; however, like-type <u>estimates</u> are acceptable for each of the alternatives being considered. If any of the alternatives do not appear to offer increased levels of proficiency, they should probably be dropped from further consideration.

### 2.03.03.01 For each alternative, have levels of proficiency anticipated to be attained by the trainees been assessed/estimated?

The analyst must realize that the clearest finding across a range of studies on technology implementation is that the selection and retention of well-qualified personnel is the most critical human resource issues to address.

Therefore, for each alternative, it is important for the analyst to assess the levels of proficiency anticipated to be attained by the trainees. While to some extent it is obvious that some training needs to be provided, it is less obvious who should be trained (supervisors or operators of the technology?), how many people should be trained (should training be provided to everyone or just to a few lead individuals?), and what methods should be used (classroom courses or on the job?).

## 2.04 Risk Assessment:

Performing a detailed risk analysis is useful to the analyst for the following four reasons:

- Resources (time, money, and management attention) can be allocated based on each project's risk.
- Candidate tasks for prototyping can be identified. Prototyping risky software functions or modules is often the most powerful method available to the analyst to reduce risk.
- A risk-optimized schedule can be generated. A risk-optimized schedule attempts to schedule risky tasks as early as possible in the project to allow sufficient time for recovery in the event of failure.
- Contingency planning is possible.

### 2.04.01 Is there the likelihood that the technology will not work as intended?

To varying degrees, the answer to this question is probably always "yes." The challenge to the analyst is to judge to what degree such is the case, and then determine the users' willingness to accept that degree of risk. For example, if the odds are judged to be 50/50, the user may find this too risky to continue pursuit of the technology. However, if the odds are estimated to be 30/70 yes/no, the user may be willing to accept that degree of risk.

Risk assessment is an ongoing process that should take place throughout the development process. During the planning phase, the risk assessment process should focus on issues that relate to the feasibility of the project. Risk, generally speaking, is directly related to the development cost and schedule. If cost is a critical issue, the risks impacting resources should be explored, and those alternatives that can eliminate or reduce these risks to an acceptable level should be identified. If scheduling is a critical issue, risks impacting the schedule have to be identified, and eliminated or reduced before the project begins.

### 2.04.02 Will the technology provide safety risks to the user?

In determining the need for the new technology, the analyst must determine whether it significantly contributes to system risk. He must answer the question of

whether or not the new technology could cause loss of life, personnel injury, mission failure, or equipment failure.

### 2.04.03 Will the technology be of uncertain reliability to the user?

The analyst must be aware that there are four forms of warranties that can be invoked contractually:

- Commercial warranty -- fixed-price warranty where the seller's liability is limited to replacing faulty parts with a like item in working order. The seller does not assume any other form of liability whatsoever. This type of warranty is straightforward and has been used for years in software contracts. Literally, it is a "let the buyer beware" warranty where the seller is liable only for replacement parts.

- Extended warranty -- fixed-price, extended duration commercial warranty where the seller fixes all legitimate failures at no additional cost to the buyer throughout the life of the contract. It is generally applied as a maintenance contract. The seller repairs or replaces the failed version with a new release that fixes the problem. The buyer waives all right to hold the seller liable for damages outside the seller's control. Timeliness of repair and responsiveness of the seller are sometimes inadequate.

- Reliability warranty -- fixed-price, extended duration specification warranty where the seller fixes only legitimate failures in excess of an allowed number based on specified reliability at no additional cost to the buyer throughout the life of the contract.

- Performance guaranty -- fixed-price, extended duration guarantees where the seller agrees to meet specific performance requirements. In case of failure, the seller is held liable for free maintenance and/or redesign and retrofit at no cost to the buyer. Performance measures could include such items as mean time between failure, response time, speed, accuracy, range, and resolution.

### 2.04.04 Is the technological risk high?

In some projects, the amount of risk is acceptable when compared to the anticipated benefits of the effort. A project may undertake to develop or explore the possibility of achieving a new capability (such as in artificial intelligence applications). Or, as another example, the development may be a prototype effort to define or eliminate a high-risk area critical to a subsequent development effort. A prototype effort is undertaken to reduce this technical risk before major resources are committed to the

development of the actual system.

## 2.04.05 Is there a risk that the user will not accept the product?

Controlling user expectations is an important part of the development process. No potential user, or customer, has a clear, complete, and firm concept of exactly what the final product will be like at the end of the project. Their expectations for the final product develop and mature during the project based primarily on discussions with the analyst and his team. If the analyst emphasizes the "bells and whistles" of the design during development, the user, or customer, will expect the "bells and whistles" and will be disappointed if they are not delivered. On the other hand, if the analyst emphasizes the functional aspects of the program, the user, or customer, will be pleasantly surprised when he is delivered what was promised along with some beneficial additional features. In short, keep the user, or customer, "focused on the steak, not the sizzle!"

## 2.04.05.01 At least annually, have you asked the user to verify and re-validate commitment to the project?

The analyst must establish a post-implementation review plan that at least addresses the following:

- Establish a time-frame for the first post-implementation review. Provide figures for the estimated system life, and a schedule for the remaining post-implementation reviews.
- A post-implementation review should be conducted 6 to 12 months following system installation to ensure that the system is functioning as designed.
- Subsequent reviews should be conducted at 50 per cent and 80 per cent of the system's life, or at least every three years, whichever is less.

## 2.05 Software Supportability:

The analyst must consider the following dominant characteristics of software supportability:

- The requirements are diverse. In other words, the system will perform a variety of functions that cannot be described in just a few pages.

- The software is not an off-the-shelf commercial product, although there may be off-the-shelf commercial products in the custom system.

- The users of the system are a diverse group performing many different tasks.

- The users, or customers, are different from those responsible for acquiring the system. For example, one would not expect a teller to be involved in acquiring the system for a bank. A teller might, however, be involved in testing the system.

- The developer is different from the acquired. Normally, the acquired has a contractor develop the system.

## 2.05.01 Will software be needed to support the technology?

The analyst must be aware that project requirements are generally of two types: (1) the statement of need from the customer or the end-user of the system, and (2) the requirements necessary to manage the project. Irrespective of management requirements, adequate attention to the statement of need, or performance requirements, is an essential prerequisite for an acceptable project. The requirements statement is the foundation for a software development decision.

## 2.05.02 Are the programming language and software compatible with existing systems/hardware used by both the developing agency and the user(s)?

In order to properly answer this question, the analyst must be aware that at the system and segment level he is dealing with entities which are normally a combination of software and hardware.

A system is a collection of hardware, software, material, facilities, personnel, data, and services needed to perform a designated function with specified results. A segment is a grouping of elements that are closely related and often physically interfaced.

Each segment consists of some combination of hardware configuration items (HWCIs) and computer software configuration items (CSCIs). Each configuration item is normally responsible for a single top-level function and is normally developed by one prime contractor.

Hardware configuration items consist of hardware components and software components. Hardware components can be further divided into sub-assemblies and

parts.

Software configuration items consist of computer software components (CSCs) and computer software units (CSUs). As much as possible, configuration items should be selected in a fashion which will allow parallel development and testing (i.e., as few dependicies between configuration items as possible).

## 2.05.03 Is the software mature and proven?

In order for the software to be judged mature and proven, the analyst must check for software quality assurance. Software defects can be divided into four broad categories:

- Requirements defects
- Design defects
- Code defects
- User documentation defects

The cost to find and repair software defects is usually highest for requirements defects, and usually lowest for documentation defects. Requirements defects normally result in improper design, code, and documentation. Design defects result in improper code and documentation. Code defects can be limited to code problems that have resulted through human error.

## 2.05.04 Is the software maintainable for the life of the project?

The analyst must be aware that the government normally requires the contractor to maintain the system for a period of time after it is delivered and in operation. This is usually a period of one to two years. If transition planning is not accomplished, the government will have problems downstream. The key transition issues are:

- Will the contractor be required to provide maintenance and support and for what period of time?
- Will the government want to transfer maintenance and support of the system to a new supplier, either at the successful conclusion of the development or at a later time?

- Will the system be recompeted at a later time to provide for major enhancements or a new maintenance supplier?
- Will the government require that system maintenance and support be transferred to the user organization?

Appropriate documentation is also necessary to support any transition, and the maintenance support facility must receive adequate consideration.

## 2.05.04.01 Have maintenance requirements been identified?

Maintenance is a support function that occurs routinely in a software project. Maintenance involves correcting faults, modifying the system to incorporate new requirements, incorporating changes that add capability, and modifications to enhance performance.

Maintenance requirements must be planned at the beginning of the project. Decisions about documentation and delivered software (especially support software and test cases) are very important if responsibility for maintenance or upgrading the system is to be transferred to the government. In many cases, the government representatives may not realize that these preparations must be made, or may assume that support of the system will be provided by the contractor. When this occurs, the government may be left with a system that is improperly documented and difficult to maintain.

## 2.05.04.02 Has a determination been made as to who will be responsible for maintaining the technical currency of the information presented by the software?

The determination of who will be responsible for the management of the technical information or content of the software is an important consideration. This task involves the gathering and retention of all relevant data. The management of this database of information requires standardized data definitions, data management facilities, and a staff in some cases, to ensure that the data is promptly obtained, properly checked, accurately entered into the data base, and effectively managed. If managed properly, the data base will always be technically current.

## 2.05.04.03 For software developed by a contractor, will the software be owned by the user without proprietary restrictions?

Since a considerable quantity of software is either developed under federal government contract, or licensed to the federal government, the government procurement regulations are relevant to any discussion of software procurement. The general policy provisions and standard contract clauses found in these regulations govern all transactions by which software and its documentation are acquired by the government.

The analyst must ensure that a special clause is included in the contract that states that the government will own unlimited rights to the technical data and computer software developed on the contract. This means that the government, as the buyer, can use, duplicated, or disclose this technical data and computer software in whole or in part, in any manner and for any purpose whatsoever, and can grant permission for others to do the same. "Technical data", in this context, refers to any recorded information – regardless of form or character – of a scientific or technical nature. It does not include cost, pricing, and management data, or other information incidental to the contract administration. "Computer software" refers to the set of instructions that cause a digital computer to operate, and all documentation associated with that process.

This clause requires the contractor to identify any restricted rights on technical data and computer software that will be used in the generation, production, or operation of items to which the contractor has unlimited rights. For example, if a proprietary software tool is needed to generate the operational software, it must be identified so that a price and appropriate rights for the software can be negotiated prior to contract.

Occasionally, this clause is coupled with a deferred delivery clause that allows the government to purchase the rights to the technical data and computer software and take delivery for a fixed price at some later time during the acquisition process. Such clauses, though rare, can substantially improve the government's leverage, enabling purchase of items at a later time when additional funds may become available.

## 2.05.04.04 Have the costs of maintenance been estimated?

The costs of software maintenance should be estimated for both in-house and contractor maintenance, and the costs compared. The system's size, complexity, and lines of code will be some of the factors driving these costs. The analyst should research maintenance costs associated with systems with similar characteristics.

## 2.05.04.05 Have maintenance manhours been estimated?

Software maintenance manhours will make up the large majority of the costs estimated for in-house maintenance in 2.05.04.04 above. As with maintenance costs, comparable systems should be analyzed to assist in estimating manhours required.

## 2.05.04.06 Are maintenance manhours supportable with existing manpower?

This question applies, of course, only if the decision has been made to pursue the option of maintaining the software with in-house resources. If the required manhours are not supportable, the option to maintain the software through contractor resources should be pursued or reconsidered

## 2.06 Hardware Supportability:

## 2.06.01 Have needs for supporting hardware been identified?

The analyst must be able to identify the needs of the supporting hardware. One technique is the use of "capacity management". This allows the analyst to ensure that the new system is properly designed and configured to give efficient performance, and that it has sufficient resources to support operating work loads. As part of this process, future work loads and required user service levels (e.g., system availability) are forecasted. Furthermore, system configurations necessary to meet the demands are proposed, modeled, and tested.

Stress testing is an integral part of capacity management. Its purpose is to ensure that the total system will successfully process workloads expected during peak production periods and other extreme conditions and to determine the point at which major system resources (e.g., processor, channels, primary storage, etc.) will be exhausted.

## 2.06.02 Will user's existing hardware be used?

The analyst must identify the existing hardware to still be used and any changes required to exercise the new technology.

## 2.06.03 Is the hardware compatible with existing systems?

The analyst must identify the hardware that is compatible with the existing systems and specify any required changes.

## 2.06.04 Is the hardware mature and proven?

The analyst must ensure that the hardware is mature and proven. This can be accomplished by requiring that all components of the system be identified and documented, and that changes to these components be controlled, recorded, and reported. Among the many components subject to these requirements are system test plans and the associated test results, and system manuals (e.g., user manuals, operator manuals, and maintenance manuals). These requirements are designed to ensure that the system meets user requirements and can be operated and maintained efficiently and effectively.

Another area for the analyst to check for hardware maturity is the results of the test plan. Test procedures should specify exactly what test inputs to provide, what steps to follow, what outputs to expect, and what criteria to use in evaluating the outputs. If any of these elements are absent, the test procedures are to be considered inadequate.

## 2.06.05 Is the hardware maintainable for the life of the project?

Reliability describes the system in terms of its probable failure rate. Useful measures may be: the mean time between failures, the number of service calls per year, or the percentage of refusals per warehouse requests.

### 2.06.05.01 Is logistics support capability in place?

To ensure that a logistics support capability is in place, the analyst must be cognizant of the following:

- Maintenance- The analyst must be aware of the status of maintenance arrangements for the new system's equipment and software.
- Personnel- The analyst must be aware of the status of personnel required to operate, maintain, and use the system.
- Facilities - The analyst must be aware of the status of facility preparation for this project.

## 2.07 User Training:

The analyst must be aware of all types of maintenance and the operator training hardware, devices, visual/audio training aids and related software which satisfy the following:

- Used to train maintenance and operator personnel by depicting, simulating or portraying the operational or maintenance characteristics of an item, system or facility.

- Training equipment must, by their nature, be kept consistent in design, construction and configuration with such items in order to provide required training capability.

### 2.07.01 Will users or trainers need special training to use the technology?

The analyst must consider an overall training strategy that would include the need for system training devices and embedded training requirements. S/he must consider new equipment training, operator and maintenance training, technical manuals and training materiel requirements for both institutional and unit training.

### 2.07.02 Has user training been specified as a deliverable for this project?

The analyst must be aware of user training issues regarding the new technology. If it is a contract deliverable, the analyst must realize that user training stresses the role and responsibilities of the user in the operation of the system. The overall responsibility is to ensure that the vendor delivers the user training as contracted.

User training can consist of describing the overall objectives and benefits of the system and explaining user procedures in detail. These procedures include;

- Data collection and preparation,

- Data transaction and submission or data transmission,

- Data base maintenance - frequency, additions, deletions, changes, error corrections,

- Reviewing and using system output and/or querying the data base,

- Balancing and control of output,
- Security/internal controls,
- User documentation,
- Job setup instructions,
- Operating instructions including restart and recovery procedures,
- Quality control,
- Output preparation including bursting, decollating, and distribution,
- User liaison.

### 2.07.03 Has an OPR been designated to design/deliver the user training?

It is important for the analyst to be cognizant of who has been designated as the Office of Primary Responsibility (OPR) for the design and delivery of the user training. The analyst must be prepared to include him or her as a major participant in the new technology development plan. It is important that training be addressed adequately and that it occur before the system is certified as acceptable.

## 2.08 Flexibility:

Configuration management is a very important topic on government projects in order to ensure the flexibility of the final product. Government projects are typically quite large and complex. They often involve concurrent development by multiple vendors. The government must insist that configuration control procedures be carefully followed throughout the project.

### 2.08.01 Can the technology incorporate job-related technological updates (e.g.,changes to equipment and/or procedures)?

Job-related changes and updates are not discouraged, but must be planned for and controlled. Classes of changes as identified by the government are:

- Class I: These changes have a significant impact on the software's user interface, technical performance, efficiency, cost, or schedule. In addition, any

changes involving modifications to the interfaces between configuration items would normally be considered Class I changes.

- Class II: These changes are considered minor. Examples include editorial changes to documentation, changes to the internal structure of software if the impact is localized and not apparent to the user, and material substitutions for hardware.

## 2.08.01.01 Are mechanisms available/in place to ensure timely notification of changes?

The analyst must be aware of the mechanisms available/in place to ensure timely notification of changes. Generally, five forms are available for use during the change control process:

- The Engineering Change Proposal (ECP): This form is used by the contractor to propose Class I changes. It includes a description of the change, justification for the change, configuration items effected by the change, the impact on integrated logistic support and operational effectiveness, impact on the project's cost and/or schedule, and results of trade-off analysis looking at alternate solutions, if appropriate.

- The Advanced Change/Study Notice (ACSN): This form is used to seek government approval to expend engineering effort to prepare a formal Engineering Change Proposal. It includes the need for the change, the configuration item(s) effected, alternatives to be considered, and a rough cost estimate. A preliminary ECP may be used in place of an ACSN. In either case, the form is submitted to the government which may reject the change or authorize the necessary engineering effort to prepare a formal ECP.

- The Specification Change Notice (SCN): This form is used to propose, transmit, and record changes to a specification. ECPs which will affect a specification, e.g., System/Segment Specification, must have a SCN form attached.

- A Request for Deviation/Waiver: This form is used to request and document temporary departures from the specifications when a permanent departure would not be acceptable. Although this form primarily applies to hardware, software development projects may use it if one plans to make preliminary or phased deliveries where the software as initially delivered will not meet the full requirements.

## 2.08.01.02 Have methods and requirements for incorporating new data into the system been established?

Methods and requirements for incorporating new data into the system should encompass the following:

- All processor instructions/operation codes (e.g., load, add, subtract, etc.) will produce known responses by the computer;
- Read, write and execute access rights of the user will be verified each time a computer instruction is executed;
- Unauthorized attempts to change, circumvent or otherwise violate system security features will be detectable and will abort or suspend the operation running; and
- An audit log or file will be maintained as a history of system use.

## 2.08.01.03 Has an OPR for implementing the changes been identified?

It is absolutely necessary that an Office of Primary Responsibility (OPR) for the implementation process be designated early in the new technology development process. This is an important issue for the analyst to address, because in any technological innovation process, there are bound to be many decision makers who play a variety of roles.

One particular role that has received special attention is that of a product or process champion. This is an advocate that who works at gaining support for change. In effect, champions provide a conduit for ideas from outside the organization, and work to continuously keep change and innovation on the organization's internal agenda. Besides acting as an advocate, the champion performs the important service of linking together the different phases of the technological innovation decision making process. The complex process of innovation in unlikely to succeed without an individual or group of individuals to take responsibility for coordinating its implementation.

## 2.08.02 Can the research be redirected or re-handled at critical points, if necessary?

A project management schedule, or a set of milestones, must be developed very early in the new technology life-cycle process. This will allow the analyst to redirect

or rechannel the research at critical points if it becomes necessary due to any unanticipated changes. A management plan of action should provide a description of the tasks, work effort and schedule required to meet the goals of the research.

During execution of the effort, technical performance measurement should be accomplished using the parameters identified in the management plan and the subtler parameters supporting it to compare achievement-to-date against the projected schedule and work effort. The technical performance measurement tasks and their correlation with contractual cost/schedule elements shall be defined to permit assessment of the program effort in terms of the schedule and cost of work increments and comparison of planned value of work accomplished with both the planned value of work scheduled and the actual cost of work accomplished. This correlation is critical to risk identification and assessment.

Knowledge of this process allows the analyst to insure that his or her research can be redirected or rechanneled at critical points, if necessary, by establishing a series of technical reviews, such as:

- Sub-system reviews
- Functional reviews
- Interim system reviews
- Major reviews
    - System requirement review
    - System design review
    - Software specification review
    - Preliminary design review
    - Critical design review
    - Functional system audit
    - Functional configuration audit
    - Physical configuration audit

## 2.08.03 Can the program be transitioned from R&D to prototype development without complete redesign and/or redevelopment?

"Research and development" is defined as effort directed toward gaining knowledge, or understanding, necessary for determining the means by which a recognized and specific need may be met. In industry, "research" includes investigations directed to the discovery of new scientific knowledge that have specific commercial objectives with respect to products or processes.

"Development" is the systematic use of the knowledge or understanding gained from research towards the production of useful materials, devices, systems or methods, including design and prototyping.

A "prototype" can be defined as a model suitable for the evaluation of design, performance, and product potential. In other cases, it can be defined as a version of a system that does not exhibit all the properties of the final system. It is usually somehow lacking in terms of functional or performance attributes.

Therefore, the analyst must be aware of whether or not his or her program can be transitioned from R&D to prototype development without complete redesign and/or redevelopment because of the potential effects that dollar costs, training time lost, implementation delays, etc., will have on the program.

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# 3. PROGRAM PLANNING

## 3.01 Coordination/Interface:

### 3.01.01 Has formal contact been made with the user or user representative?

The identification of the user or someone who has been designated to represent the user. But this must be done, and it must be done early, or your efforts will be for naught. Initially, go through your chain-of-command. If that is not productive, contact Air Training Command or the Air Staff training and education offices within DCS Personnel. Areas such as OJT or ancillary training are so widespread that it may have been necessary to designate someone at one of those levels to act as the user representative.

Once the user or user representative is identified, formal contact should be made to begin what should be a continuing dialogue throughout the project. Early and frequent involvement of the user (your "customer") will help avoid problems down the road.

#### 3.01.01.01 Has the user or user representative agreed to the need for research?

The project should probably not be undertaken if this question cannot be answered affirmatively. It is a good idea to get this agreement in writing in terms of a memorandum of agreement, or some comparable document.

#### 3.01.01.02 Has the user or user representative "bought into" the research approach?

It is preferable that this "buy-in" be obtained early-on; however, that is not necessarily critical for all projects. The research approach and the user's acceptance of it may evolve over time, particularly for more complex efforts.

#### 3.01.01.03 Has a user representative been identified as a focal point or participant on the research team?

Having a user representative on the research team would be the ideal situation, but

it may not be practical or affordable. It is essential, however, that a focal point be identified who can represent the users' views. This person should be in a position of sufficient authority to make commitments for the user.

### 3.01.02 Have interdependencies with other projects been identified and incorporated into project schedules and plans?

Check within your organization, and with the user or user representative to determine whether there are other projects in progress or being planned which will require inputs or outputs from, or interface or coordination with, your efforts. This should be done early on in order to avoid duplication or scheduling problems later. (See question 3.05.02.)

### 3.01.03 Will the technology interface with other types of training/training devices?

This is important to establish early on, and it is just as important to remain sensitive to it throughout the life of the project. HQ ATC is probably one of your better sources for this type information, as well as your own organization. There may be instances where interface is not an issue, but where it is an issue, it is essential that it be addressed.

### 3.01.04 Has coordination been effected with other interested or affected agencies, e.g., ATC, AU, AFIT?

You can't do much in the area of training without having an affect on ATC, or in PME without affecting AU, or in education without affecting AFIT. The appropriate organization needs to be kept informed throughout the project. And there may be others as well, such as the Air Staff, the AF Occupational Measurement Squadron (AFOMS), the AF Military Personnel Center (AFMPC), etc. The important thing is to coordinate your activities frequently with affected agencies.

### 3.01.05 Have potential operational impacts been identified?

You may have to get down the road a ways before making this determination, but it must be made and communicated to the user to mitigate adverse impacts. You and the user representative need to work closely on this question. Identification of operational impacts should be an item of particular interest during operational test and evaluation. Impacts may differ before, during, and after implementation, and they can be either positive or negative.

### 3.01.05.01 Will units possibly face temporary reduced readiness during implementation?

This should be addressed as a specific element of question 3.01.05 above. If reduced readiness is anticipated, make sure the emphasis is on "temporary."

### 3.01.05.02 Will operational resources (manpower, dollars, equipment) be impacted?

If your project will result in resource savings, you're probably in good shape and you will be appreciated by the user. If you forecast that your project will result in the need for more resources at the operational level, you probably should reconsider the whole effort – it is doubtful such a project will receive user support. At the very least, you should be prepared to demonstrate the benefits which might justify the cost.

### 3.01.06 Have potential operational impacts been discussed with appropriate operational officials?

This should be done as soon as operational impacts are identified. The user representative can help you identify who should be advised. Don't yield to the temptation to avoid this one – to do so will hurt not only your project, but follow-on efforts of your agency as well.

### 3.01.07 Have actions been taken to minimize potential operational impacts?

These actions can take many forms, and should be formulated in close coordination with the user representative. The use of comprehensive development and operational testing is probably one of the better ways to identify and minimize operational impacts.

## 3.02 Funding:

### 3.02.01 Have funding source(s) been identified for this research?

Hopefully, this is somewhat of an academic question at this point. If a funding source hasn't been identified, there is no way the project can proceed. If the proposed project has the support of the user, but no funding source has been

identified, steps should be taken to find a funding source. Start with your chain-of-command and internal comptroller activities. If this is not fruitful, staff a proposed funding request to the user for funding support. If a funding source hasn't been identified by now, you can expect the start of the project to be delayed considerably, if not cancelled altogether.

### 3.02.02 Have funds been allocated for this research?

Just because a funding source has been identified (question 3.02.01) doesn't mean the project has been funded unless the funds have been allocated or committed specifically to the project

### 3.02.03 Are allocated funds adequate?

If the project isn't fully funded, what can you do? There are at least four options. The project can be cancelled, changed in scope, delayed until full funding is obtained, or fully funded through other means. This decision must be made in close coordination with the user representative.

### 3.02.04 If funds are not adequate, have steps been taken to request/obtain additional funding?

In most instances, this is probably going to be the preferred alternative in response to question 3.02.03 above. The process is essentially the same as described under question 3.02.01 above, that is, check your chain-of-command first, then attempt to negotiate with the user for supplemental funding.

## 3.03 Staffing:

### 3.03.01 Has an accurate assessment of manpower requirements to accomplish in-house research been accomplished?

Hopefully, this was done as part of the "costing" of the project. It should be an objective determination of manpower or manhours required to accomplish the project, without regard to availability of manpower for the moment (availability will be established later).

## 3.03.01.01 Will increased manpower be required to support the research?

This is merely a comparison of required and available manpower.

## 3.03.01.02 Can increases be satisfied through realignment of existing manpower resources?

Your chain-of-command must make this determination based upon availability and priorities. If the answer is no, you again have at least the same four options addressed above under Funding (question 3.02.03). The project can be cancelled, changed in scope, delayed until manpower becomes available, or fully funded from a manpower standpoint through other means. (If full dollar funding is available, but adequate in-house manpower resources are not, consideration can also be given to initiating or expanding contracting out of the effort. See question 3.03.02.)

## 3.03.01.03 Are potential user agencies willing to relinquish manpower resources on a temporary basis to support research efforts?

It doesn't hurt to ask! If the project is of sufficient priority to the user, this may be a workable solution. Expect the project, or at least some segment of it to be delayed, however. It normally takes time to transfer manpower authorizations and assign the right personnel to them.

## 3.03.02 Has a determination been made as to which parts of the research will be done in-house versus contracted out?

This determination should be made early on. If work is to be done by contract, time must be allowed for its preparation, processing and approval. Criteria to be used in making this determination include the availability of capability, talent, expertise, equipment, and/or facilities; availability of funds; and cost effectiveness.

## 3.03.02.01 Is it more cost effective to contract out the research, or portions thereof?

This is a must, especially if required capabilities are known to exist in both in-house and contract sources.

## 3.03.03 Have in-house resources been identified to perform the research?

This refers to personnel resources (people, faces, flesh and blood) as opposed to manpower resources (spaces, authorizations) referred to under question 3.03.01 above. Have the people which the research requires been identified by name? Note the emphasis on required – availability is a separate issue and is addressed later.

## 3.03.04 Are personnel identified to perform the research adequately and appropriately skilled?

Hopefully this was taken into account when identifying the people required to work on the project, but if they're not, steps need to be taken to get them "up to speed," recognizing that this could delay the project, or parts thereof, in addition to possibly adding to the cost.

## 3.03.05 Are the personnel needed to conduct the research available?

If the answer is no, you again have at least the same four options addressed above under Funding (question 3.02.03) and manpower (question 3.03.01.02). The project can be cancelled, changed in scope, delayed until the right people become available, or fully funded from a personnel availability standpoint through other means such as borrowed labor. (If full dollar funding is available, but adequate in-house personnel are not, consideration can also be given to initiating or expanding contracting out of the effort. See question 3.03.02.)

## 3.03.06 Is the organizational placement and supervision of the research appropriate?

This can be a difficult issue in a military organization. Sometimes projects begin in the right place, but as they mature their focus changes to the point that the project and the people working on it become the illegitimate children in the organization. This can result in lack of management attention, reduced priorities or funding, reduced morale, and probably a very unhappy customer (the user). If this happens, or for whatever reason the project was incorrectly assigned in the first place, this should be brought to management's attention, and hopefully corrected.

## 3.04 Facilities:

### 3.04.01 Are the facilities to conduct the research available?

You need to think beyond your own agency in assessing the availability of facilities. Think in terms of required user, contractor, and test facilities as well. Also, think beyond office/lab space. For example, if the development, procurement, and/or use of training devices is contemplated, plans for their facilitation must be made well in advance.

### 3.04.02 Are necessary supplies and equipment available?

The same issues apply here as for question 3.04.01 above.

## 3.05 Time-line:

### 3.05.01 Has a time-line been developed?

The sophistication of the time-line will depend largely on the complexity of the project, but even the simplest of projects should be placed on a time-line or schedule. The time-line should be challenging, but realistic and acceptable to the user (see question 3.05.03 below).

### 3.05.02 Where interdependencies with other projects have been identified, have time-lines been synchronized?

Refer to question 3.01.02. If interdependencies have been identified, they must be taken into account when developing your project's time-line. Failure to do so can delay your or others' projects. And don't forget these interdependencies if unforseen circumstances cause the need for adjustment to your time-line as the project proceeds.

### 3.05.03 Is the time that is necessary for research, development, and testing congruent with users' expectations for availability?

This should be established early in the planning stages of the project. If unforseen

circumstances subsequently cause the need for adjustment of the time-line, the user representative should be consulted immediately. You'll have an unhappy customer if you wait too long and surprise him/her later.

### 3.05.04 Does the time-line include the point at which you expect to move from R&D to prototype development?

This is a significant and important milestone to the user, and a lot of advance planning needs to be associated with it. It should be monitored closely, and if schedule changes occur, be sure that all affected agencies/personnel are kept advised.

## 3.06 Contracting (if used):

### 3.06.01 If required, has a Request for Proposals been written?

The primary function of the Request for Proposal (RFP) is to convey to industry exactly what it is that the government (you) wishes to procure. Two skills are required to develop meaningful RFPs: mastering the technological areas that must be covered in the RFP for accomplishment of the research; and understanding the laws, regulations, and policies that govern RFP format and content. Few individuals are experts in both. Consequently, you as the technological expert need to be able to communicate with, and obtain assistance from, procurement specialists in preparing an RFP.

### 3.06.02 Has an appropriate Statement of Work been developed?

Within a Request for Proposal, the Statement of Work (SOW) identifies the requirements which you want the contractor to address during specific phases of the research. The focus is on the contractor and the SOW language defines the minimum required contractor efforts, to include deliverables.

### 3.06.03 Have the conditions of the contract, e.g., fixed price, cost plus, 8A set-aside, been established?

If a contract is to be used, the conditions of the contract should be established early on between you and the procurement specialists.

### 3.06.04 Has a contractor been identified/selected to perform the research?

If so, identify here for the information and benefit of all concerned.

### 3.06.05 Are provisions in place for contract management?

These provisions should include technical as well as cost and schedule management. This can be done through periodic interim progress (or "how-goes-it") reports/briefings established as contract deliverables.

### 3.06.06 Is the contract adequately funded?

If the answer is no, you have at least four options to consider. The project can be fully funded from other lower priority sources, cancelled, changed in scope, or delayed until adequate funds become available. If none of these are considered viable alternatives, the distribution of work between in-house resources and contractor should be reevaluated to determine if more can be done in-house.

### 3.06.08 Are procedures in place for reacting to, and decision making concerning, options raised by the contractor(s)?

Such procedures should be included as part of the overall contract management plan, and the flexibility allowing the contractor to raise and address options should be included in the Statement of Work in the Request for Proposal.

# 4. TEST AND EVALUATION

Testing and evaluation of a technology involves empirical data collection on a prototype and/or a final version. The objective of this process is to assess whether or not the technology works as intended.

The testing process should examine the technology on two levels. First, it should assess the operation of the technology itself, which, in this section, will be referred to as **"system performance"**. Second, the testing process should evaluate the capacity and willingness of users to utilize the technology for it's intended purpose. This concept will be referred to as **"user acceptability."**

Checking the performance of a new technology is usually done as a series of steps. The first step, **"laboratory testing"**, is performed to ensure that the technology operates as intended, and is reliable over an extended period of time. The second step is a **small scale field trial with typical users.** This field trial has three objectives: to examine if the technology can be used as designed, if it is comfortable for users, and if it is effective (at least in the limited and well-controlled environment of the field trial). This field trial is frequently referred to as an evaluation of the "efficacy" of the technology.

If the technology fulfills all requirements for approval in stages one and two, then the third and final step is a **large-scale field trial.** The objective of this final field trial is to both examine the processes and anticipate the problems that might occur during deployment (process evaluation), and discover whether the intended outcomes of the technology are achieved under conditions similar to those that would be encountered in full deployment (outcome evaluation).

## 4.01 System Performance:

For the following sub-sections, the term "system" is defined as: "the set of components, developed to work together to produce a training result". For example, a technical system designed to provide training for a maintenance operation may include: specified simulation equipment, software for controlling the simulator, detailed instructions for using the simulator and programming the software, and perhaps an information package for training the instructors/managers in using the equipment. Each component in such a system requires testing and evaluation, both individually and together as a system.

## 4.01.01 Are there clear and exact specifications for how the technology is intended to operate?

The focus of this checklist item is on what the technology is intended to do. The criteria and standards discussed below detail how these specifications are to be measured. The specifications should include performance or process dimensions as well as the intended outcomes.

Specifications for what the technology is to do – and with what degree of exactness and reliability – should have been written prior to the development of the technology (see Section 2.01: Identification of Technologies). These specifications should be reviewed and updated as needed, prior to any testing and evaluation. If technical specifications are not available, or have not been written, this should be done immediately.

Sources of information for developing specifications include the following:

- **Technical Developers**: They can indicate the types of performance dimensions the system is intended to address, and the technical capacities of the hardware and other components.

- **User Representatives**: They should have some input in indicating what they want the technology to do for them.

- **Other Technical Experts**: They may know what similar types of technology were able, or unable, to do in other circumstances. They may also be able to offer suggestions on features that were desired for similar systems but never implemented. Other experts may be able to offer helpful suggestions about the new system based simply on knowledge about the theory underlying its design.

An important aspect of developing specifications is to determine whether the technology is a "complete package of specified activities" intended to be turned over to the users and replicated as designed, or a "flexible tool" intended to be used for a variety of purposes and adapted by the users to their own needs. For example, a personal computer is a good example of a flexible tool. It is obvious that a computer has many potential uses, these include writing and printing text, maintaining records, analyzing data, and running software for teaching about technologies or any other topic. This flexible type of technology may be more difficult to evaluate, because its effectiveness depends on the appropriateness of the user's application of the system, and the prior knowledge and experience that the user brings in applying it. In order to be effective, a tool must not only be well-engineered and reliable in itself – it must be used appropriately.

Pitfalls to avoid when developing specifications:

- Focusing only on the technical performance aspects and neglecting the user's performance resulting from the use of the technology.

- Both under-specification and over-specification, in terms of the level of detail included. Unless a technology is very complex with many components, ten to twenty major performance dimensions should provide sufficient specifications.

## 4.01.02 Have criteria been identified against which to test performance?

Criteria for testing performance are the actual measurements that will be taken to "operationalize", or clearly demonstrate the attainment of, each specification. In general, each technical specification should have one or more criteria for it's measurement. These criteria may be technical characteristics of the hardware, such as the operating speed of a computer when processing the training software, or a measurement of user performance, such as learning a certain task with a specified degree of accuracy within a specified time period when using the technology. In general, criteria are developed by answering the question, "What measurements will we take in order to know whether or not this technology is performing as intended?"

## 4.01.03 Are a priori standards available for those criteria?

In general terms, there are two major approaches for making judgments about the effectiveness of a technology. One approach is to compare the data acquired in the testing/evaluation process against *a priori* standards. An *a priori* standard is a benchmark or performance goal that can be specified in advance, such as, "Using this technology, at least 80% of trainees will learn the specified tasks to 95% accuracy within 2 hours of training." The other approach is to use comparisons with data from some other technology or procedure (discussed in the next item).

If a priori standards are available, or can be developed, their use simplifies the evaluation process, because measurements from comparison groups are not required for judgments of effectiveness. When the performance of the equipment and/or the trainees meets or exceeds the performance standards, then by definition, it is effective. The use of such standards is sometimes called an "accounting" approach to evaluation, because it uses logic similar to the accounting profession. In accounting, the acceptable practices and degree of accuracy necessary for "legally correct" performance are set in advance.

To establish attainable a priori standards, there must be enough experience with the technology, and with the capabilities of the users. The standard should represent a goal of improved performance or excellent performance, without being so difficult to achieve that developers, trainees or other users find it unrealistic. If a standard is viewed as unrealistic, it is likely to be ignored both when making decisions and in practice. If this situation occurs, then it is obvious that the standards will not be useful for evaluating the performance of either the equipment or the user.

The use of *apriori* performance standards requires that the major audiences involved in both the use and development of the technology are in agreement on the standards to be applied, in advance of the evaluation data collection. These audiences and "stakeholders" include: those who will make further decisions concerning continued development and deployment of the technical system, those who have been responsible for developing the technology, and representatives of the ultimate users. Specifying the standards and negotiating agreement on their details among the relevant officials, may require considerable time and effort.

If measurements are collected on a new technology without a basis for comparisons, it creates considerable psychological pressure within the organization to decide that the technology is "good enough" and to continue developmental or deployment funding. This may result in the tendency (with findings well documented in the research literature) for organizations to continue sinking development money into technologies that are not effective, in attempts to "protect" the investments - both financial and personal - already made. Decision makers should be encouraged to use test and evaluation data to cease investments in ineffective technologies with no harm to their professional reputations or careers, as well as to continue investments in effective technologies.

Sources of performance standards:

- From the technical specifications of "state of the art" technical equipment similar to that being tested, such as the latest data concerning expected capacity and speed of personal computers.
- From the measured past performance of the technology (or the procedures) that the new technology is intended to replace.
- From professional groups that specialize in the relevant content area. They may be able to specify standards for minimal acceptable performance or provide a definition of what can be considered a significant increase in performance.
- From technical experts in the content field, whose experience may suggest reasonable goals.

Several caveats to the use of performance standards have been mentioned above, including the importance of obtaining agreement on the specific standards in advance, and the necessity that the standards be realistic and achievable, in order to be useful. Further, if performance standards are used for larger scale field testing, it is important that local mediating factors that are likely to influence performance be considered when judging the effectiveness of performance against the standard.

## 4.01.03.01 If answer to 4.01.03 is "no", will the technology be compared with another technology, such as that currently used?

The second approach to making judgments about the effectiveness of a technology is the familiar "experimental design", in which the new technology or procedure is systematically compared with another technology. The comparison might be the equipment or procedures currently used in the field for the same purpose, or another new technology that is also under development. This sort of comparison can sometimes be used as a "horse race" to find the winners among a number of competing products. The discussion under items 4.01.01 and 4.01.02 of specifications and measurement criteria still apply, but now judgments are made by comparatively examining how well several technologies reach the same specifications.

Sources of guidance on how to set up and conduct an experimental test can be found in the research methods literature of each discipline relevant to the type of technology being tested. The scope of the experiment should differ a great deal depending on the stage of the performance testing. Initially, small-scale comparisons within the laboratory setting are likely to be needed to test the technical performance of the innovation. Then, controlled comparisons under field situations should be arranged, preferably with the same users testing both technologies. If different sets of users are needed, choosing comparison settings that are as similar as possible. For technologies that are intended to affect an organization-level operation, such as new methods of recording and tracking the training operations of a unit, the comparisons may need to be a large-scale trial among several different bases.

## 4.01.04 Have methodologies for initial test(s) been determined?

The preceding sections have discussed some considerations that will go into the decisions made about initial and full-scale testing. This item is a summary of the range of issues to be considered in designing the initial test(s). The final determination of methodologies will include:

- An itemization of the specific measures that will be used, These

measures, in turn, are based on the technical specifications.

- Decisions on the objectives and scope of the initial test: is the purpose to demonstrate operational procedures and obtain pilot data? Or is it to obtain a more thorough test of effectiveness? If the purpose of this stage is to test effectiveness, then a choice between the judgmental approaches will be needed, i.e., testing against a priori standards or against one or more comparisons;

- Determining how the data will be collected for the measures to be taken.

- Specifying analytical techniques to be used (if statistical procedures are needed to summarize and synthesize large amounts of data).

For exploratory or pilot testing, a number of approaches may be applicable, depending on the nature of the technology. These include the following:

1) For hardware components, test each element of the technology individually to examine whether it works as intended. If the reliability of the parts or consistency of operation may be a problem, then the test should be repeated as many times as necessary to check the reliability of that type of equipment. What is likely to be the weakest link, physically?

2) For components requiring a human interface, enlist testers who are not familiar with the technology and provide them with the instructions or training they would receive in the field – then observe their attempts to use the technology. This is likely to require bringing naive users into the laboratory or developmental environment. A small number of testers (perhaps 8 to 12) is likely to be sufficient to check the operational aspects of the technology.

The operational tests should incorporate such questions as:

- Are the instructions sufficient for the user to operate the technology?

- How long is the learning time required?

- What are the testers' reactions as they attempt to use the innovation?

- Are they able to use it as intended?

- Do they like it?

- What sources of difficulty, if any, do they experience?
- How do they think the technology would fit in their normal working environments?

3) For technologies intended to deliver training to improve learners' performance, initial observations of all aspects involved in assessing learning will be required. Again 8 to 12 "typical learners" should employ the new technology and report their reactions. At this stage, the objective is not yet to test effectiveness in improving their performance, but simply to document whether the learner can operate the technology, and to answer such research questions as:

- After the expected level of instruction, can the learners function on the technology with the anticipated degree of independence?
- Are the instructions clear?
- Can the learners flow from one part of a learning package to another as needed?
- Do they like using it?
- What types of difficulty do they experience?
- Do they seem to make adequate progress in their learning?

4) If the initial testing will involve multiple trial users or learners, it would be valuable to conduct a focus group (a discussion group led by a moderator to gather qualitative information about a given subject) with each group of testers at the end of their testing period. This group should be conducted by an experienced group discussion leader to elicit a thorough recording of the testers' experience with the technology. Some potential questions:

- What did they like or not like about the innovation?
- What problems or difficulties did they experience?
- Does this type of technology seem appropriate for people like themselves?
    - Does it have gender connotations?
    - Does it have status connotations?
    - Do those from any particular type of background or ethnicity feel

it has any special meaning for them?

- Is this type of technology likely to be accepted into their work environments?
- Will the technology have physical requirements (e.g., for space, electricity, temperature control) or maintenance that are difficult to meet in their environments?

This type of discussion can be conducted within a one to three hour period. The benefit of a focus group is that it may elicit more subtle considerations that will greatly affect the acceptance and performance of the technology in the field, but was not factored into the technical design specifications or procedures.

### 4.01.05 Have "typical users" been identified to participate in the initial tests?

This item refers to the kinds and sources of individuals who should participate in the various initial tests discussed in item 4.01.04. These "typical users" should not simply be the lab staff or friends of the developers in the laboratory, for these individuals are likely to have technical background and abilities much different from that of the eventual users. In selecting the "typical users" one should include all major categories of users: trainers or OTJ supervisors who will be in charge of the technology, learners (if the technology is to support learning directly), training supervisors, and maintenance and support personnel.

Specific arrangements for test personnel should be made with the appropriate authority of some operating units similar to those that will eventually use the technology. This may require TDY to bring these individuals (about ten of each major type of user, for example trainers and learners) into the laboratory for them to "put the technology through its paces". However, a prototype of the system might be transported to a typical user environment for this stage of testing.

### 4.01.06 Has initial testing shown that the technology operates as expected, and is compatible with normal user capabilities? (If "no", return to development phases.)

This item refers to the first decision point in the testing and evaluation process. The data collected from the initial tests -- quantitative results, qualitative comments and focus group results from the trial users - should be carefully assessed. This assessment should be performed by a decision level or by an outside body that does not have a vested interest in the continuation of the technology development project.

The information from initial tests of the operational characteristics should be compiled and assessed. Most importantly, information about any problems that were revealed should be analyzed in light of the following questions:

- Are the problems easily correctable or do they appear to involve fundamental flaws in the design of the technology or in the "fit" between technology and user?
- If the technology seems to operate as intended by the designers, but the users do not like it, are there features that can be changed to make it more "user friendly"?
- Is the technology one that is rather foreign to the intended users' initial frame
- Is the decision is reached to continue with larger scale efficacy testing, what procedures will be used in the further trials to overcome user opposition in order to obtain full implementation and an adequate testing of efficacy?

The result of this analysis should be a decision to follow one of three courses of action:

1. To stop development of this technology at this time, because there appear to be either major problems in its conceptualization or design, or the cost of making the necessary design changes would outweigh the benefits.
2. To return to developmental phases to correct problems, improve documentation for users, modify instructional materials, improve the training package, or make other corrections. Selection of this option means that there is a clearly defined course of action for correcting the problems identified. This option may include making only minor modifications before proceeding to a field trial.
3. To proceed with a fuller scale trial to test the efficacy of the technology, specifically to find out if it can produce the effects intended for users or learners.

## 4.01.07 Have appropriate methodologies for an initial field trial (or other procedure to test efficacy) been selected?

The key objective of this step in testing and evaluation is to assess whether the new technology can produce better results for users, under carefully controlled conditions. "Better" may mean: in relation to a set of *a priori* standards for the technical specifications, in comparison to usual practice or another technology, or as compared to another technology (as discussed above in items 4.01.03 and 4.01.03.01). In most cases, the measures of efficacy will be objective measures of performance, such as the accuracy and speed of learning when using the technology, or the accuracy and amount of time (efficiency) needed to maintain records using a new technical system. Measures of users' opinions about the technology or their perceptions of ease of use are also worthwhile, but these do not substitute for observed measures of change in user performance.

If the overall design of the testing will be based on a comparison with set standards, the major concern will be to obtain a sufficiently large, representative sample users to know whether the average level of performance using the technology to know whether the average level of performance meets the standard. The initial trials should have indicated whether the level of variability among users is large, to help specify the size of the performance testing needed. This testing should also be done in enough different locations to include the different types of users coming from a variety of backgrounds, to determine whether all user sub-groups can meet the standard using the technology.

If the overall design will be a comparison among technologies or against current practice, the specific types of comparisons must be defined. The comparison technology should be one that has the same purposes as the test technology, so that the same measurements can be used and results can be compared. If feasible, it is desirable for test subjects not to know which technology or procedure being tested is the "primary candidate" being developed. This ensures that they will not attempt to influence the results concerning efficacy, either positively or negatively, by their own feelings about the technology they are using.

Another important factor is the specification of the measurement tools and procedures that will be used to assess efficacy. Usually, these will have been developed along with the specifications as part of item 4.01.01 and .02, but they should be re-examined at this point to be sure they are still relevant. The specific types of measurements taken to assess efficacy will depend on the nature of the technology and its objectives. If the design of appropriate measures is in question, then textbooks, reference sources or experts on that type of technology should be consulted.

The number of test subjects or situations needed for a comparison depends on several factors. One is the magnitude of the differences expected among the technologies being tested -- if large differences are expected, then a smaller number of subjects are needed to detect and confirm the differences in outcome measures. If the differences among the technologies are expected to be small, they may be hard to detect among the other sources of variations in the measures taken. If this is the case, then the number of test subjects needs to be much larger. A second factor in determining the number of test subjects needed is the extent of "naturally occurring" variability or "noise" among the test subjects. If this natural variability is minimal, then fewer test subjects are needed to detect the expected differences in performance due to the new technology. If little is known about how much variability to expect, or how large a difference might be produced by the new technology, then pilot data may be needed to make a valid estimate. Statistical advice may be needed to calculate the sample size needed to detect the effects of a variable.

If a high degree of precision is needed in the resulting data -- such that small differences are likely to be important -- then a randomized, controlled experimental design ought to be used. In this design, the test subjects or situations are specified and listed, and sometimes pre-tested to assess their current levels of performance. Then they are randomly assigned to the "experimental condition" (using the new technology) or to one or more "control conditions" (using the comparison technologies). The process of randomization helps to insure that background differences between the test subjects, which might affect their results, do not differ in a systematic way among the experimental and comparison conditions. More importantly, randomization allows the legitimate use of many statistical procedures to make inferences concerning the effects of the new technology.

The proceeding discussion of the numbers of test subjects and the various types of experimental designs is particularly relevant in the testing of technologies intended to influence the performance of people, and for those technologies which require a human operator as a part of the overall technical system. The performance of people is well known to vary considerably, even under normal circumstances. Such factors as: the extent of applicable education, previous experience with that type of task or equipment, interests and aptitudes, and many others affect individual differences in performance. Therefore, the procedures used to test the effectiveness of new technologies must be sophisticated enough to distinguish between human performance variations that are due to the technology and those that are due to the fundamental differences between people.

Furthermore, if the technology will be used by varying groups of people, the final tests of effectiveness should factor in the range of differences between the test subjects, and include sufficient numbers of the different types of people, in order to examine whether the technology will be equally effective with a wide variety of

users. If the testing and evaluation is solely of hardware technologies, and quality control in manufacturing can assure little variation among individual examples of the same technology, then experimental testing using substantial numbers of subjects or sites should not be necessary.

Selection of a methodology for field trials of efficacy should also include the overall plans for analysis of data. Usually, statistical tests will be used to infer whether any differences in results, between the target technology and whatever it was compared to, are larger than the random variation that would occur by chance. The appropriate statistical tests are related to the specific comparison design used, particularly the fact of whether or not test subjects were randomly assigned.

### 4.01.08 Have location(s) for an initial field trial been selected, contacted, and permission obtained for conducting the test?

This item refers to the necessary logistics for conducting initial field trials. More than one location may be needed if: the technology involves organizational aspects of the training system, testing one technology would "contaminate" users and bias their results when testing another, or the evaluation design requires more participants in the trial than are available on one base. A key aspect is to select location(s) with pools of potential users that are reasonably representative of the ultimate users, but still have some variability in the types of test subjects available. The locations to be directly compared should be as similar as possible in their relevant characteristics. The location(s) should also be close enough to the site of technology development so that the developers can easily participate and observe the initial trial. Responsibilities for conducting the trial would best be served an evaluation team that is separate from the developers, to avoid any potential conflict of interest.

A number of practical tasks are involved in conducting a trial. The level of authority for requesting permission to conduct the test will vary depending on the numbers of test subjects to be involved, whether the trial is a short term (for example, can be completed in one day) or longer term trial, and the scope of base activities affected.

Planning for all the logistics needed to conduct the field trial should include at least the following considerations:

- What is the expected schedule for conducting the trial, including planning time, preparation of materials, notifications, conducting the trial and collecting data, restoring test sites to "normal", analyzing data, preparing reports, and reporting.

- How will test subjects/participants in the trial be notified of this activity and what will be expected of them?

- How will participants' immediate supervisors be notified about the trial? Will they be able to affect the schedule for the trial, so that it does not conflict with other essential activities?

- Who will be responsible for on-site implementation of the target technology and of any comparison technologies? Does this person have sufficient authority to obtain the cooperation needed?

- Who will be responsible for on-site data collection? Ideally, this person should have technical expertise in the data collection methods to be used and should be familiar enough with the base to obtain needed support. Will training for data collectors be provided?

- Are the tools and instruments needed for data collection available in sufficient numbers, and on site? Has their accuracy been calibrated?

- Who is responsible for monitoring on-site data collection? Is there a procedure for quality control to ensure adherence to intended schedules and procedures?

- How will the data be transferred from the test locations to the office responsible for analysis and reporting results?

- Will test participants be de-briefed about the trial? Will it be immediately or after the results are known?

## 4.01.09 Will a large-scale field trial be needed to test for user acceptability, deployment within field conditions, and/or reliability of performance across time and adverse contexts?

The result of the previous item, 4.01.08, should be a succinct report with accurate data answering whether the new technology is able to produce the required results, and if a comparison trial has been used, whether it performs better than the comparison(s). This report should also include enough information about the trial for the audience to know how it was conducted. This means including good documentation of methods and data to demonstrate that the technology was implemented as intended during the trial. In concluding the report, a decision must be made as to the future course of action. Two judgments are needed:

- Does the initial field trial provide strong data that the new technology is effective in producing the intended results? Is it sufficiently better than current practice to justify a decision to move toward full deployment, with a replacement of current practice?

- Will full deployment involve changes of such a magnitude in the user environment that further data collection from a large-scale field trial is needed to ensure effective operation of the technology?

For most technologies used to support field level training, the answer to the second question will be "yes", given that these technologies nearly always involve interactions between the technology and the users. This question should be answered "no" only when the technology can be deployed into the field and will work as intended without human users and without disturbing other ongoing activities in that environment; surely an unusual technology! If the answer to both decisions is "yes", then the technology is ready for further field trials.

The final testing might be conducted as feedback data collected during the first year or two of partial deployment. Alternatively, a larger-scale field trial of effectiveness within real conditions may be needed, particularly when extensive changes are needed in the field in order to fully implement the technology. Large scale trials often use an organizational entity - squadrons, units, a particular type of agency, or even whole bases - as the basic unit of analysis. Trial organizations should be selected and data collection and analysis designs prepared using methods similar to those for the field test of performance efficacy. Comparison sites (other organizations) may also be needed, for example, if the costs/benefit ratio of full deployment is an issue. Most of the issues to be addressed in the large scale field trial are discussed in section 4.02 on User Acceptability.

### 4.01.10 Is appropriate methodological expertise available for testing the efficacy of technical performance and the effectiveness of the technology within field conditions?

The evaluation of technology performance is a multifaceted task requiring the skills of staff members from a variety of backgrounds. For each discipline, those who perform the testing and evaluation should be different staff members from those who do the technology development, to avoid any bias in the findings or conflict of interest. If new or modified hardware is involved, then engineering research and testing skills are needed from the appropriate engineering discipline. If software development or applications are part of the technology system, then appropriate computer programming or software engineering skills are likely to be required.

For assessing the human side of technology performance, a variety of skills are likely to be needed, which may require the collaboration of several individuals. The testing of individual learners' performance, particularly of cognitive or "thinking" tasks, will require someone experienced in educational testing. Specific skills are required for developing test items to analyze the learning domains addressed by the technology, and for performing the statistical analysis to assess whether positive outcome effects are demonstrated. Examining the performance of the overall technology system in a field situation will require program evaluation skills. These skills are required: to develop an overall design appropriate to the objectives; to develop measuring instruments or to work with other technical specialists in developing measuring tools; to develop the specifics of the data collection procedures (including training those who will collect data); to manage the logistics of a large scale field study; and to employ appropriate statistics when analyzing the data. To the extent that the new technology will interact with the on-going operations and activities in the unit-level environment, the evaluation team should include a person skilled in analyzing organizational behavior and its change. Each of these people will bring to the test and evaluation team skills from their own training and expertise to help understand the operations and effects of the new technology.

## 4.02 User Acceptability

This section addresses the evaluation of issues likely to occur during full implementation of the technology in the field. When used in this section, the term "users" include all those involved with the technology in its field deployment. This means not only learners and trainers, but also their supervisors, maintenance personnel responsible for the technology, office managers and agency planners, and the command level officers managing unit-level operations. The term "users" may also include organizational entities, as a new technology may affect the standard operating routines for getting things done within an organizational unit.

Obtaining intensive feedback from typical users during the initial testing and efficacy trials is a critical part of the process, and has already been discussed (in section 4.01). This initial testing will provide an understanding of the types of reactions to be expected from the field, and whether specific activities will be needed to foster user acceptance. If the technology is welcomed by users as a solution to their needs, and one that is easy and enjoyable to use, user acceptability will pose few problems. However, if potential users liked the "old way" of doing things, then user acceptability may become a major issue. For example, changes that involve the preferred roles of key staff are likely to be resisted, such as a change for trainers from in-person, classroom-type instruction to supervising computer-based instruction.

Also, technology deployment requiring organizational-level changes, such as new communication links, supervisory relationships or work flow patterns, will definitely require systematic examination of the activities needed to ensure user acceptance within those organizations.

## 4.02.01 Have users' specifications and criteria for acceptable performance been identified?

As the discussion of criteria (in section 4.01.02) has indicated, users' concerns may be different from those identified by the developers of the technology. It is vital to include users of all the types indicated above in creating the specifications and criteria. Before a major field trial, these items should be reviewed with representatives of each type of user group to ensure that all concerns are addressed.

Before full deployment, or during the early stages of full deployment, it will be vital to obtain in-depth information from users to understand their reactions. This can be done with focus groups or open-ended interviews with a range of initial users. In some cases, it may be difficult for users to articulate their concerns, particularly if they involve issues outside of performance, which might be perceived as "illegitimate". Technology that appears to be a threat to one's status or preferred role may be resisted, even if there is evidence showing its effectiveness. For example, many individuals in higher status occupations resisted using personal computers when they were first available, perhaps partly because the keyboard requires the use of typing, previously associated with lower status secretarial positions.

Often new technology may be advocated in order to increase efficiency, which means that some positions may be eliminated, thus threatening jobs. This is a key concern when down-sizing is a mandate. Efficiency for the organization as a whole may mean the loss of a valued role, or even unemployment, to the specific individuals performing the tasks to be eliminated. Sometimes, such concerns are real ones -- part of the cost of the new technology. Other times, these types of concerns are unfounded, and efforts should be taken to dispel them. If such concerns exist and are not addressed, the actions of those who fear they will be affected may undermine the implementation of the technology, and counter the performance advantages that would otherwise be possible.

## 4.02.02 Have decisions been made on when user acceptability will enter into testing and evaluation - e.g., in the lab, in initial field tests, in larger-scale field trials?

Since technology, by definition, involves the application of a knowledge-based

devise by a user, user acceptability should enter into the testing and evaluation at all stages, with increasing emphasis as the testing and evaluation proceeds from the laboratory to the field environments. Several types of user acceptance should be considered: users' capability with the technology, users' concerns regarding its advantages and disadvantages to themselves, users' commitment to the technology, and user organizations' compatibility with the technology.

> Capability refers to the technical background and skills brought to the technology by the new users. Does each intended user have the ability to use the technology? If motor skills, keyboard typing or simultaneous manipulation of multiple controls are needed for the technology, for example, a period of practice may be needed to obtain or refresh the muscle skills required.

The design of the technology may also assume certain background knowledge or prior training that may not be present in all users, or may have been forgotten. Even if the requisite skills and knowledge are present, individuals may not feel confident that they will be able to use the technology, and may be reluctant to "expose their ignorance."

> Concerns refers to users' beliefs, even fears and anxieties, regarding the value of the technology for themselves on a personal level. As discussed above, even if the innovation would be effective in the aggregate, users may fear that it will have negative consequences for them. Unless the deployment strategy diminishes these concerns, potential users may consciously or unconsciously resist the new technology.

> Commitment refers to users' motivations and levels of rewards from using the technology. Users' motivations may come from both internal and external sources. Internally, they may like the technology, have fun using it, feel a personal responsibility or involvement in it, or find it an intellectual challenge similar to a game or puzzle. Positive external motivation comes from perceptions that implementing the technology is an important part of one's job, and that this activity is valued by one's supervisor and co-workers. Participating in a trial of the new technology or even visiting a successful trial site can increase the commitment of others to try it for themselves.

> Compatibility of the user organizations and the technology refers to the "fit" between the two. Such congruence has many aspects, including how the technology fits into or clashes with the local organizational culture ("how we do things around here"), whether it is consistent with the priorities of local commanders, whether it fits into or requires changes in unit work flows and normal worker tasks, whether supportive communications are already in place, and so forth. User acceptance should be examined at both the

individual and the organizational levels.

Decisions about when and how to examine user acceptability should consider all types of user acceptance. The data resulting from this assessment, and any recommendations for actions needed to support deployment will be heavily affected by the types of user acceptability considered and measured. It is a common mistake to lump these dimensions together under the label of "user attitudes" or inherent "resistance to change". In fact, many of the difficulties of deploying new technologies can be traced to initial incompatibilities between the technology and the organizational environment, which call for different types of solutions than motivational efforts to improve worker "attitudes".

### 4.02.03 Have appropriate methodologies been selected for determining user acceptability?

In general, two quite different types of methodologies are available for examining user acceptability, both generally done in the context of a trial or early stage deployment of the technology to the field. One is to use in-person qualitative evaluation methods; the other is a sample survey to obtain representative data from a wide range of users.

Qualitative (also called "naturalistic") data gathering procedures emphasize understanding the situation surrounding the use of a new technology from the point of view of the user. In qualitative data gathering, multiple methods are used to understand how the technology is implemented locally, including non-participant observation on site, informal interviews, case studies of the events accompanying the technology in a new environment, and open-ended interviews with a range of participants and stakeholders in several sites. These methods are particularly appropriate for understanding workers' concerns and fears and for examining the degree of compatibility between technology and local organizational operations. Such qualitative examinations are generally carried out during the first six to twelve months of the use of the new technology, preferably using multiple sites to examine whether processes and concerns are generally the same across sites. If large differences in the level of implementation or in the nature of users' concerns occur between sites, a more thorough examination may be necessary.

Quantitative survey methodologies for assessing acceptability among representative samples of users are probably most useful after the technology has been deployed in multiple sites for about one year. This method can be used to check on the type, intensity, and level of use that has been obtained (if other data are not available for this purpose), to assess the users perceptions, levels of commitment, and confidence about using the technology, and to get their perceptions of the organization's use of the technology. Often, many informants from the same units (or other

organizational entities) are included in the sample to check the consistency of responses obtained from the same unit. The information obtained from small scale qualitative interviews may be used to construct questionnaire items for a sample survey. The selection of respondents for the survey should include enough individuals from specific organizational units to characterize these units (by aggregating the individual data), as well as a statistically representative sample of the population of individuals using the technology.

An important pitfall at this point is to assume that as soon as the technology is deployed in the field, it will be implemented correctly. There are many examples of technologies shipped to local sites only to sit unused, sometimes still in their packing cartons, because issues of implementation were neglected. Follow-up data to assess user acceptability and organizational implementation are essential. If the results reveal lower than desired use in the field, further actions may be necessary to increase the extent of implementation and, thus, the effectiveness of the technology. These actions might include further organizational analysis and change to enhance organizational compatibility, train-the-trainer programs for increasing user capabilities, technical assistance for modifying work roles or increasing communication, or obtaining greater support from local supervisors through chain-of-command directives.

### 4.02.04 Is appropriate methodological expertise available for evaluating user acceptability?

The expertise needed for assessing user capabilities will be similar to the skills needed for examining the effectiveness of the technology, with an emphasis on program evaluation and implementation assessment within organizations. These skills are most likely to be held by a researcher with a background in organizational sociology or psychology, organizational study in anthropology, or the applied aspects of communications research or political science. The essential element is previous experience and skills in collecting data within and about organizations. Data syntheses will usually involve combining information from qualitative and quantitative analyses to put together a picture of the extent of technology implementation in the field from the points of view of its multiple users.

# 5. IMPLEMENTATION/DEPLOYMENT PLANNING

## 5.01 Cost-Effectiveness Analysis for Deployment:

The analyst must ensure that the following tasks are accomplished prior to making a new system deployment recommendation:

- A comprehensive evaluation of projected benefits (i.e., personnel reductions) is completed that justifies the system;
- Potential work loads are analyzed to determine needed capacity, processing, and performance requirements for the system;
- Hardware alternatives are evaluated and the best and most cost effective one is selected; and
- An operational test and evaluation of the complete system is successfully completed to determine its operational effectiveness and suitability.

### 5.01.01 Has the production cost per unit of the technology been determined for potential large scale deployment?

An important first step in choosing the best system design alternative is identifying the work load requirements that the system must satisfy. An analysis of projected work loads helps define the capacity, processing, and performance needs of a system prior to deployment. A cost/benefit analysis of each alternative that meets these requirements should then be performed to determine the potential production cost per unit. These steps help ensure that the best alternative is chosen.

### 5.01.02 Has the average effectiveness of the technology been determined under "real world" conditions?

Military regulations for system development, test, and evaluation reinforce the importance of testing a completed system. These regulations state that the approval of a system for deployment should be supported by fully developed and tested computer programs. These regulations also state that deployment should only take place after the successful completion of both a development test and evaluation stage and an operational test and evaluation stage.

The purpose of the system development and testing phase is to discover and correct problems, and to determine if the entire system works as intended. To field a

system when it is only partially developed and tested increases the risk of problems occurring later in the development cycle when they are more costly and more difficult to correct.

### 5.01.03 Have the resources needed for effective large scale implementation been identified?

The final result of the developmental process is the funding of the implementation of the project within the resource constraints of the organization. Use of these resources must be planned and coordinated early in the life cycle process. Types of resources required for an effective large scale implementation are recurring costs for operation and maintenance, such as :

- Training
  - Equipment
  - Services
  - Facilities
  - Personnel
- Industrial Facilities
  - Construction/Conversion/Expansion
  - Equipment Acquisition or Modernization
  - Maintenance and Repair
  - Materials, Supplies, Utilities, and Other Services
- Personnel
  - Crew Pay and Allowances
  - Maintenance Pay and Allowances
  - Indirect Pay and Allowances

## 5.01.04 Does the increase in average effectiveness justify the cost of production and deployment of the technology?

To reduce the risk of fielding systems that do not work as intended or cost more than necessary, the military requires full development and testing and a complete analysis of alternatives before a system is deployed. Lack of knowledge of the increase/decrease in effectiveness does not justify taking shortcuts and unnecessary risks in deploying the system.

## 5.02 Implementation Management:

Implementation management is very important to the analyst because after all the science, invention, development, selling and adopting, the new technology has to be implemented, or all the effort is wasted.

## 5.02.01 Has a transition plan between the developer and user been developed and approved?

A transition plan must be developed between the developer and the user that includes consideration of the following issues and events:

- A system test: Performed to determine the acceptability of the system's functioning and data to the system users.

- Formal user acceptance: The analyst must obtain a written sign-off by the designated user acceptor. This sign-off indicates that the functions and data provided by the system meet the user's requirements.

- Generate production initiation notice: All organizations affected by the system implementation date must be notified. This notification must state how the new system will affect them, and what must be done for preparation. This notice will include:

    - Schedule: Give the date and time for system implementation and phased activities, including any parallel operations that are planned.

    - Effect: Give a summary of the effects of the new system, and explain the differences between the old and new systems.

    - Coordination: Specify what activities must be completed by the user to assist in system implementation, including training

system users.

  - Contacts: List personnel contacts for the system.

- Prepare software change control procedures: These procedures are used to maintain software integrity, minimize life cycle software costs, prevent unnecessary or marginal changes, establish change priorities, assure prompt action on changes, document these changes, and control the release of changed software and documentation.

- Prepare user training material.

- Obtain production acceptance: The system is considered operational and no longer developmental after production acceptance by the system's custodians.

- Prepare operation instructions: These instructions are for running the application system. Personnel should already be trained on the operation of the equipment, operating system, peripheral devices, and non-application software.

### 5.02.01.01 Has an agency/office been designated to manage the implementation process?

The analyst must determine what agency/office has been designated to manage the implementation process. This office is responsible for certifying that the new system performs according to the user's functional and data requirements.

### 5.02.01.02 Has analysis been conducted to determine what operational procedures or other activities will be changed or replaced by the new technology?

This is largely a user responsibility; however, the analyst can expect to be asked for input. In addition to what procedures and activities are affected, the analyst should address where, when, and how the new activities will occur. If current procedures or activities are documented in regulations, pamphlets, operating instructions, etc., these documents will require changes or replacement (see 5.03.07).

## 5.02.01.03 Will use of the technology free operational equipment that was previously required to conduct certain phases of training?

One measure of implementation effectiveness is the measurement of any improvements in equipment utilization. The analyst must realize that one of the issues involved in effective implementation is whether or not the use of the new technology free operational equipment that was previously used to conduct certain phases of training.

## 5.02.01.04 Have the activities needed to implement the new technology been identified?

The analyst must develop an implementation plan for the new technology that could be designed as follows:

- Implementation strategy. Using the acquisition strategy, the current system (if one exists), and the project plan, the analyst must decide:
    - if the implementation will be gradual or "phased";
    - if parallel operations are necessary;
    - if a conversion is necessary; and
    - what is the best implementation method.
- Timing. The analyst must determine when to implement the system based on information such as the new fiscal year, policy effective date, resource availability, etc. An implementation schedule must also be developed.
- Responsibility. The analyst must identify responsibilities for activities such as site preparation and acceptance, initial procurement of supplies, and implementation coordination.
- Affected organizations. The analyst must identify organizations affected by the implementation and notify them of their preparation responsibilities.
- Operations. He must define operational functions, and make resource estimates and commitments.

## 5.02.01.05 Has it been determined how items will be supported? (e.g., supportability funds, in-house or contract.)

It is very important to the analyst that the determination be made early in the project life cycle as to how the new technology will be supported once it reaches the implementation phase. This allows for proper resource planning, budgeting, and timeliness in the implementation phase.

## 5.02.02 Will potential users/managers of the technology need to be trained in its use?

It must be decided if potential users/managers of the technology need to be trained. If there is a training requirement, the analyst must develop a user training plan, such as:

- Training plan scope and content. The analyst must identify the equipment, software, and procedural training needed for management, administration, development, user, and operation personnel.

- Personnel training requirements. The analyst must identify training needs and when the training should be conducted.

- Presentation methods. It must specified if the training will be formal (classroom) or on-the-job, and if all similar training can be conducted at one time or if it must be phased.

- Training space and equipment. It must be determined if the space required for training, any special training equipment (such as audio-visual), and any technical support equipment is available.

- Funding. Any training costs must be identified and a budget prepared. This budget should include costs for instruction, materials, travel, etc.

- Training team. The person(s) responsible for negotiating and administering training must be identified.

## 5.02.03 Will users and supervisors have time available to learn to use the new technology?

The analyst must determine whether or not users and supervisors have the time available to learn to use the new technology. If training is required and time is available, the analyst should establish a training plan as outline in paragraph 5.02.03 above.

## 5.03 Implementation Resources:

### 5.03.01 Have funding sources been designated for all aspects of deployment and implementation, including hardware and software purchase (as needed); training of users; local supplies, equipment, and facilities; and maintenance on-site?

Although these funds and their sources are probably largely within the purview of the user, the researcher should take an interest in verifying their availability. If implementation resources aren't fully funded, the project might have to be cancelled, changed in scope, or delayed until full funding is obtained.

A good place to start in verifying the availability of funds is...

### 5.03.02 Is there a manpower impact (plus or minus) associated with implementation of the technology?

This should be determined before implementation, probably as a result of test and evaluation. Once known, it should be communicated to the activity(ies) impacted in order that adjustments can be made in a timely manner. If there is an additive manpower cost, sources will have to be found for those additional authorizations, and that can take time and extensive effort. If there are manpower savings, you'll be someone's hero!

#### 5.03.02.01 Is the manpower impact in user agencies?

This and the following question should normally be addressed together, for an increase in one activity's manpower may be offset by a corresponding decrease in the other. This requires a coordinated effort between you, the user representative, and the affected training activity.

#### 5.03.02.02 Is the manpower impact in ATC or other training agency?

See question 5.03.02.01 above.

## 5.03.03 Is appropriate staffing available for managing implementation, local use, maintenance, and updating the technology?

This is basically a user issue, but you should assist by identifying the management requirements.

## 5.03.04 Are needed facilities, equipment, and supplies available and assigned at the unit level?

This is basically a user issue, but you should assist by identifying the facility, equipment, and supply requirements.

## 5.03.05 Has an appropriate time-line been designed for carrying out implementation processes?

The sophistication of the time-line will depend largely on the complexity of the project and its implementation, but even the simplest of projects should be placed on a time-line or schedule. The time-line should be developed in close coordination with the user representative.

## 5.03.06 Is the production availability of the technology and all supporting equipment congruent with the time-line established?

If it is not, actions need to be taken to synchronize schedules, either through expedited production (which may be costly), or adjustment of the time-line. This issue must be worked in close coordination with the user representative.

## 5.03.07 Is the use of the new technology compatible with existing regulations and procedures?

If compatibility does not exist, new regulations and/or procedures may have to be written, staffed, and produced. At the very least, it can be expected that changes to existing regulations/procedures will probably be required. In any case, the user will look to you as the expert who can assist in the drafting of any new or changed procedures.

# 6.0 DOCUMENTATION AND FOLLOW-UP

## 6.01 Documentation of Development Process

### 6.01.01 Have the decision and development processes for the technology been documented to specify what lessons were learned during development ?

The primary focus of a research and development effort is to produce some sort of gain in efficiency or productivity. As the investigation moves forward, decisions are made such as: which avenues of research should be pursued, what shape the final product should take, and when and how the final product should be implemented and so forth.

Recording these decision and development processes, as trivial as they may seem, is productive for two reasons. First, it offers a guide to those who wish to work with the technology in the future. The variables involved in any system are always changing, and any perceived "maximum" will not be as permanent as it may seem. In the future, researchers may want to update, expand on, or reinvent the technology. For this purpose, a record of the rationale behind all decisions in the original research effort should be maintained. Furthermore, a second reason that such a record may prove useful is in the unfortunate event that a new technology fails to accomplish its purpose. If this occurs a record of decisions will be critical to understanding why the technology failed. This record will also expedite the effort to find a solution to the problem.

### 6.01.02 Have lines of research that were not productive been documented to prevent needless replication ?

Documenting those lines of research that were followed in the original effort but found not to be productive should be documented as well. This will allow future researchers to better understand the process of thought that directed the effort in the current project, and will avoid any duplication of effort if any attempts are made at improving the technology in the future.

## 6.02 Documentation for Technology

### 6.02.01 Has documentation been written for the new technology ?

More often than not, the creation of training manuals, maintenance guides, and other documentation for new technologies are given less attention than other areas in the research and development effort. Although this aspect of implementing a new technology may not be quite as exciting as the more investigative, hands-on

development effort, it is critical to the success of the new technology. The efficient use of any technology is entirely dependent on the users understanding of the process involved in using the technology to accomplish the activity.

Many of us have seen that simply giving a computer to a worker does not immediately increase that workers productivity. There is a time lag due to the resulting "learning curve" – the time required for the worker to learn how to use the computer to accomplish the activity. This is true for all activities that are new to the person working with the technology. Good user documentation is the key to accelerating the learning curve. For this reason, documentation should be given careful consideration.

## 6.02.02 Is documentation available for different types or levels of users?

A useful strategy for accelerating the learning curve mentioned 6.02.02 is to provide documentation for users at different levels. This allows advanced users to operate at the level at which they are comfortable. Further, one can also provide new users with information about the technology in a format that is not intimidating. Often, new technologies will be intimidating to new users. Unfortunately, those people that work closely with the technology in the development stages often find it difficult to adopt the perspective of the new user for purposes of creating a simple clear, practical guide to the new technology. Consulting a new user is often useful in accomplishing the creation of an effective introductory level manual.

## 6.02.03 Has documentation been tested for clarity and usability among the intended users?

Regardless of the level at which the content is presented, such as beginner or advanced, the information should be presented in a clear, understandable fashion. As stated in item 6.02.02 above, those people that work closely with the technology in the development stages often find it difficult to separate themselves from their advanced understanding of the system in order to ensure that they are not assuming any prior knowledge on the part of the reader. Consulting a user representative, if one is available, is a valuable way of verifying the clarity of the documentation.

## 6.02.04 Is documentation available for maintaining the technology?

All systems, tools or technologies that may require maintenance should have documentation providing the expected frequency of maintenance activities, what activities should be performed, how they should be performed, and who should perform them.

Although maintenance activities for some systems are performed by specialized personnel, in most situations, it is advisable to provide maintenance documentation as reference to those that will be working closely to with the technology. This allows for both the ability to do simple troubleshooting and avoid extended down time, and also allows advanced users to increase their understanding of their tools.

## 6.03 Follow-up

### 6.03.01 Are there provisions for follow-up data collection to determine whether the technology is operating in the field?

Verification of system performance is a critical part of the technology development process. Appraisals of field performance ensure efficiency by catching weaknesses in new equipment before they impede progress in other areas. Making provisions for follow-up data collection, and informing users and their supervisors that such an effort is to be arranged will allow this data to be used to optimize for maximum performance.

### 6.03.02 Is the technology being used as intended?

Part of the follow-up data collection process described in item 6.03.01 should involve a verification that the equipment is being used as intended. It is important to understand that improper use of equipment can take place in very subtle ways. The type of misuse that is most common is not, for example, a high-speed modem being used as a door-stop, or a cellular phone being used as a paperweight. The most common type of misuse comes from the failure of the user or the developer to properly communicate the way in which the technology should be used. This is the type of situation where, for example, a user tirelessly repeats a long sequence of keyboard actions to make the system perform a certain function, unaware that the machine has a feature which allows for long, repeated key sequences to be stored in memory and executed with a single touch.

It is also important to be aware that on some occasions users find ways to make the technology perform *even better* than was intended in the design process. If this is indeed the case, these improvements should be communicated to the original development team and, if found to be safe and effective, spread to other users. This type of user innovation, when performed in an intelligent, safe and non-hazardous manner, should be encouraged and rewarded.

## 6.03.03 Is there evidence of user satisfaction with the products?

Verifying user satisfaction can be accomplished through surveys, on-site inspection, and informal interviews with users and/or supervisors. User satisfaction ensures that the implementation of the technology will be smooth and successful, and that expected increases in efficiency and productivity will be gained. Verification of user satisfaction also ensures that the developers of the technology will be perceived as quality conscious. This will increase the likelihood that the user will maintain contact with the developers in the future about this and other systems, ensuring a good communication between the two interdependent parties.

## 6.03.04 Are changes, revisions, or modifications required?

If the follow-up investigation shows that changes, modifications or revisions are required, then a report should be submitted back to the original development team (or a comparable group if that is not possible) for analysis. It is important that the redesign take place as soon as possible in order to maintain the implementation process. If too much time is spent on analyzing the need for revisions, then the enthusiasm and optimism created by the original implementation will be lost. It is also important to document the revisions made and append this information to the original report on the research and development process.

## 6.03.05 Have procedures been established for production of meaningful progress reports?

Progress reports on the first significant period of use for a new technology are beneficial for both users and developers. Most new systems will prove or disprove their usefulness and sustainability within 6-12 months. For this period (or more or less as required) progress reports will allow the developers to monitor the use of the technology in this critical period. A formal procedure should be established for these progress reports to be submitted: the appropriate user and/or maintenance representative should be appointed, a time period for the reports (monthly, quarterly, etc.) should be decided upon, and a listing of the critical parameters to be measured should be provided to those responsible. Developers should also allow time for feedback, even if minimal, to be provided to those who write these reports, to help maintain their interest and motivation in monitoring the new technology.